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Storm Losses

THE storm damage in North Carolina suggests the importance to central stations of a comprehensive record of costs of casualties of this nature. Small losses due to wind and precipitation are to be expected and belong properly in normal operating expenses. No one can anticipate where heavy losses will occur or calculate accurately upon the resulting extraordinary expenditures. These visitations of nature are without precise parallels. Several years ago the Railroad Commission of Wisconsin made a study of losses from particularly destructive storms; two years ago Indiana and Ohio utilities suffered heavily from unprecedented floods. Such facts point to the existence of valuable data. In places where it is a periodical experience to have losses of some severity but not of extraordinary financial cost the expense can be included in rates, but so simple a solution is not always commercially practicable when disaster comes once or twice in a lifetime. One way to provide is by distributing the expense over a period of, say, five years, but that puts the cost upon consumers after the occurrence of the unwelcome event, not upon those who were receiving service at the time. Better financial protection is assured by a reserve fund, the proper amount of which cannot, unfortunately, be determined in advance, but which, even though very small, is a safeguard against dangerous depletion of resources.

An 8 per Cent Return in New York

ALLOWED rates of return may be expected to differ substantially in various localities, but it is significant that 8 per cent on the agreed valuation is permitted to the New York Telephone Company in the financial stronghold of the country. A return of 8 per cent on $82,000,000 is equal to 6 per cent upon $109,300,000. The valuation claimed by the company was reduced by the Public Service Commission, Second District, but the acceptance of the reduction was evidently coupled with a clear understanding of the fact that the rate of return leaves some leeway in dealing with capitalization. If one-half of the valuation be assumed to consist of bonds and the interest cost on those be estimated at 6 per cent, the return available for the remaining stock capitalization would be 10 per cent. Part of the excess on the bonds above the exact interest cost thereon may be applied to returns on elements not accepted in the valuation by the commission if there be any such. That is to say, 6 per cent might go for bond interest, 8 per cent for stock dividends, and the excess above necessary bond interest for returns on the smaller amount the propriety of whose capitalization the commission now rejects. The grounds on which the commission declines to recognize certain elements in capitalization may be precisely the grounds which courts would hold valid.

Central-Station Gain in Income

THE continued strength in central-station income, revealed by the statistics compiled by the ELECTRICAL WORLD as published elsewhere in this issue, stimulates confidence. Our returns for January, 1915, show 4.8 per cent gain in income and 1.7 per cent gain in output as compared with January, 1914. Since September the record in income has been somewhat less favorable. The percentage of increase is over one-half of the percentage of increase in May, 1914, the month in which our compilations were started and the best month as to gain in income reported by us. The increase in output in January was less favorable. Excepting only November, 1914, it was the smallest gain in output in the nine months covered by the tables. It represents a decline from increases that were around 12 per cent and 13 per cent in May, June and July, 1914. That the rate of increase in income held so much better than the rate of increase in output is attributable, of course, to the loss of low-rate business on account of industrial inactivity.

Continuous Waves in Radiotelegraphy

LONG-DISTANCE radiotelegraphy has already become so far developed, from an engineering point of view, that its efficiency is a matter of practical importance, that is, the ratio of the power received at the receiving station apparatus to the power delivered at the switchboard of the sending station. The more usual form of the expression is, however, the ampere ratio, or the ratio of the current at the base of the receiving antenna to the current at the base of the sending antenna. This ratio in long-distance radio transmission is of the order of from 10^{-7} to 10^{-6}; or something like one-ten-thousandth of 1 per cent, so that it is not on the same plane as the ampere efficiency of electrical apparatus in energy transmission. Considered as a device translating from electric to radiant power, an incandescent lamp has a very poor power efficiency, but, by comparison with efficiencies in radiotelegraphy, it is extraordinarily efficient. However, in its operation the incandescent lamp turns its wasted energy into locally distributed heat. The radio machine liberates its wasted energy into large space, some into the soil or ocean, some into trees and buildings, much into the

atmosphere, and perhaps some into interstellar space. In his paper on "Continuous Waves in Long-Distance Radiotelegraphy," read at a recent meeting of the American Institute of Electrical Engineers, Mr. L. F. Fuller discussed the relative advantages of damped and continuous waves for long-distance radio transmission. The conclusion is that continuously generated waves are somewhat more effective and efficient than damped waves. Without going into the mathematics of the problem, this is not a surprising deduction, because if waves of a given initial frequency and amplitude are emitted in damped groups, it is manifest that the average strength of the group must be less than the initial strength, to say nothing of the effects of discontinuity when the group is stopped and the next wave train is started. Consequently a mode of generation in which the initial amplitude and frequency are steadily maintained for an indefinite period ought to have an appreciable advantage. Abundant experimental evidence recorded in the paper tends to show that disturbances of radio waves are developed in transmission. The origin of these disturbances is not yet fully established, but it would seem that they are to be looked for in the upper strata of our atmosphere.

Feeder Protective System

In our Digest this week will be found an outline of the Callender-Waters system for automatic protection of underground feeders. As our readers well know, much effort has been spent on the development of such protective systems during the past few years and several of them are in service in England with various degrees of success. In the one now described an ordinary cable is surrounded just under the lead covering by copper tapes alternately belonging to the two sides of a relay circuit. If anything of a serious character happens to the cable, the relay circuit will be closed and the feeder will be automatically disconnected at both ends. Certain modifications in the connections make it possible to use the scheme on either alternating-current or direct-current feeders, although, of course, its most important function would be the protection of the long high-tension lines which most need automatic cut-outs. The principal difficulties with all these systems of cables containing combined protective devices are, first, the cost of the protective device, which makes a cable highly special in character, and, second, the added difficulty of laying and caring for such cables, particularly with respect to making joints and protection against surges and other causes of abnormal voltage.

If one could start fresh with almost any system of distribution and work out the logical arrangement of feeders and mains for the supply, he would probably find that proper protection to the system could be secured with relative ease. Most of our present difficulties arise from the fact that the networks have been built up piecemeal in an incoherent and inefficient way, which affects the costs adversely and the factors of safety to an even greater degree. Concerning the automatic protective devices, it is impossible yet to say whether, on the one hand, they are to be regarded as the logical development of a safety system or, on the other, as useful and somewhat costly makeshifts forced upon us by unfortunate lack of foresight. Whatever may be the facts in the case, the automatic-protection plan deserves a thorough trial in service, since, even if it be applied only to some essential portions of a distribution system, it may avert a serious disaster to the service by its prompt action. Holding on to a short-circuit, either wilfully, as when in the old days it was considered good form to burn out a fault, or unwittingly, as may happen in any system of large size, is likely to involve serious consequences to the public, and hence, whatever view one may take as to automatic protection, it is not wise to cast the plan aside without an honest effort to discover its real merits.

Renovation of Interborough Plant

In this issue is described the enlargement of the generating station of the Interborough Rapid Transit Company, of New York City, now being made to keep up with the increasing load to be thrown upon the system as the new railway lines go into service. The situation is a particularly interesting one on account of the fact that the plant now being reorganized is of comparatively recent design, having been in service only about fourteen years. It was constructed at a critical period in power-plant development, being, in fact, one of the very last of the large reciprocating-engine installations. The steam turbine had not then reached a state of development where its future was certain. The change now being inaugurated is from the old prime mover to the newer, four large reciprocating-engine sets being displaced by three turbo-generators. The four displaced units were of 7500-kw rating, while each of the three new units has a rating equal to the entire four engine-driven units now displaced. The condenser plant, which was originally of the jet type, has been changed as far as the turbines are concerned to surface condensers of the class now very generally employed for large units. The boiler plant as yet remains substantially as built initially. It consists of units of 500-hp nominal rating, considerably smaller than would now be used in a plant of this magnitude, but the comparative newness of the equipment rendered the change uneconomical at present, and the principal alteration, or rather addition, is that of standard superheaters for all the boilers, giving 200 deg. of superheat, even when the boilers are hard pushed.

Aside from the changes in the main units of the plant, steam turbines have replaced reciprocating engines in driving various auxiliaries, and there has been a complete remodeling of the electrical distribution features of the plant with the special end in view of protecting the underground cables from damage in case of short-circuits. Reactors of large capacity are inserted between the generator and the main bus, and between this and the auxiliary bus, and other changes in

the distribution system have been made to assure simpler and safer performance.

Considering the plant as a whole, the most startling change has been the prodigious increase in the output of the station by substituting turbines for the old reciprocating engines. These did honorable service and have had their day. Reciprocating-engine units were never developed in this country to the point of economy which was really practicable and often attained in Continental practice. American engineers seemed for a long time afraid of triple expansion, of high boiler pressures and of the high superheat which are common and advantageous features of foreign practice. This backwardness was, perhaps, not without its reward in that it helped on the cause of the turbine in no small degree so that in the long run little or no advantage was lost. Present indications point to the advantage of boiler units considerably larger than those now employed in the plant under consideration, but sound economy dictates retaining a good and serviceable boiler plant at least during the time of rebuilding and transition. The changes wrought in the Interborough power house are a monument to the rapid change of the art in the first decade of the current century, and point the way for further advance in generating-station economy.

Principles of Rate-Making

From time to time we have published many articles on electric rates. On the whole, the most complete discussion of the subject in recent years is contained in the article by Mr. A. S. Ives concluded in this issue. This article covers ground ordinarily not dealt with in the consideration of rate-making. In the history of electric distribution there have been many schemes of charging for electrical energy and service, based upon many theories and great diversity of practice. In a rough way electrical rates may be divided into three parts, or rather three classes—contract rates, meter rates, and what Mr. Ives refers to as load-factor rates, rates based in some form on the amount of use of the connected load or the maximum load at any time demanded.

The first division embodies the earliest idea in the sale of electricity during the period before suitable metering instruments had been developed. In this case the price charged was a simple matter of bargain and sale, based fundamentally on an assumed use of the lamps or motors, and carried out in practice by various special contracts. In short, the central station charged frankly what the traffic would bear, arranging such figures on the basis of a regular service charge. This method of rate-making was extremely crude and involved the station in many unpleasant tangles owing to one customer finding out what rate another one was obtaining. Everybody, including the customer, was relieved when metering became the general rule. Metering in its ordinary form appeared good enough, but it was based on a misconception, namely, that one could so closely average the conditions of service to all classes of customers that a meter rate, with a mere quantity discount, would come sufficiently near satisfying all consumers. Comparatively short experience showed that the result was quite different. As a matter of meeting the service conditions of the station, the method was a failure in that a peak load was rated on the same basis as a twenty-four-hour-per-day load consuming the same total energy. Moreover, it proved to be very inconvenient, and this, perhaps, was the real cause of its undoing, in that it was a failure from the standpoint of charging what the traffic would bear. Subsequently came the evolution of a great group of so-called load-factor rates, the numerous modifications of which Mr. Ives discusses very effectively. Rates of this kind give prominence to the standby charge and make it extremely easy, by combination of a demand charge with an energy charge, to arrange a discount curve possessing almost any characteristic required to meet the exigencies of local service. If, for example, there are in any territory a considerable number of large consumers—isolated plants let us say—who can be served only at a rate which would be ruinous if extended to all customers, it is perfectly possible to devise a combination demand and service rate which shall meet the requirement of charging what the traffic will bear with respect to this particular group without extending unjustifiably great discounts to others. The same general device, in one form or another, has therefore become very widely used as giving rise to perhaps the maximum flexibility in producing a general discount curve suitable for meeting the conditions that may arise under almost any circumstances.

From the practical standpoint the principal fault of all such rates lies in the fact that they are complicated and apt to affect certain classes of customers in a way that is disadvantageous. When one considers the total number of factors which go to make up any rate supposed to take account of them all, he discovers that complete adjustment of each factor involves complications beyond hope of solution, and it has therefore been the invariable practice of rate makers to choose certain items as independent variables and to average the others. The selection of the items which should be chosen for treatment in each of these ways has involved great diversity of practice. By no means have the important factors always been made the independent variables. For example, the distribution charge against the individual consumer, depending chiefly upon his distance from the station, is a quantity almost invariably taken by general average because no community would agree to that particular kind of discrimination in charging for the service rendered to its several members; moreover, the time of maximum demand, which quite commonly is much more important than its absolute amount, is very infrequently considered in spite of the fact that the old two-rate meter scheme had many good features. Each actual rate is the result of many compromises in the treatment of the component factors. In any event, some form of load-factor rate seems best to meet present requirements, with the sole qualification that it must not depart too widely from simplicity.

LETTERS TO THE EDITOR

Letters of Messrs. Tripp and Matthews on Business Conditions

To the Editor of the ELECTRICAL WORLD:

SIR:—I was very much interested in the symposium on business conditions by Mr. Guy E. Tripp, of the Westinghouse Electric & Manufacturing Company, and Mr. Claude L. Matthews, of W. N. Matthews & Brother, which appeared on page 517 of the ELECTRICAL WORLD of Feb. 27. They agree on most points, but seem to be in disagreement on that question regarding which no one expects anybody to be able to convince anyone else who does not want to be convinced, namely, the tariff.

At the outset allow me to disclaim any intention of trying to settle the tariff question in a manner satisfactory to all parties in the controversy. I simply wish to make a few suggestions regarding factors which must be considered by Republicans and Democrats alike if they expect to evolve any tenable conclusions regarding the relation of tariff legislation to business conditions in the United States.

Mr. Matthews asks if it is not a fact that "the real cause of this unprecedented business depression" is that, owing to the destruction of property in Europe and the enormous expenditure of funds by belligerent governments, the supply of European capital which is normally invested in new enterprises in the United States is now drastically cut off, intimating that it is this influence rather than the lower tariff duties which restrains business activity.

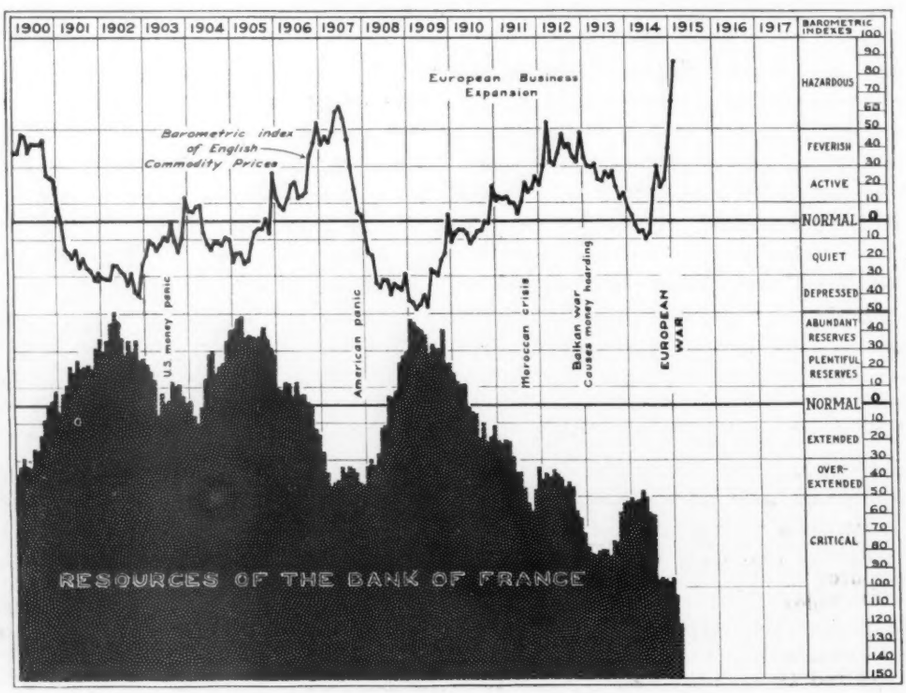
Mr. Tripp replies that "while the present inability to obtain foreign capital by reason of the conditions in Europe is a handicap, it can scarcely be considered the sole or principal cause of the business depression beginning long before the present war was entered upon and at least coincidental with the general agitation for legislative regulation of all business, the uncertainties in manufacturing industries due to prospective and actual tariff legislation, and the lack of earning power of the railways."

Both will agree that business activity is influenced by the supply of investment capital and by legislation. The difference of opinion seems to be as to the weight which should be assigned to the tariff, and it is important to every voter that he should arrive at some intelligent opinion regarding how much weight should be assigned to each factor affecting business conditions, else there will be much misdirected political agitation, owing to the lack of what might be called the "scientific attitude" toward political questions. It is an axiom of science that the more comprehensive the phenomena observed and analyzed, the more reliable and accurate will be the deductions formulated. In this discussion the phenomena considered in relation to the present business depression by these two gentlemen are, first, the supply of capital and, second, the legislative activities of our government.

The New Tariff Law and Business

There is no doubt that business has become worse and worse ever since the Democratic tariff law went into effect a little over a year ago; consequently, the Republican feels justified in ascribing the business depression entirely to the lowered tariff duties. Economists and business men alike disagree as to the merits of protection and free trade, but everyone is agreed that the purpose of lowered tariff duties is to let in a greater supply of foreign-made goods in order that prices may be lowered. Hence, when Mr. Tripp says that the reduction of tariff duties was responsible for an increase of $133,000,000 in our imports from March 1 to Aug. 1, 1914, we are all agreed that the lower tariff duties would have a tendency in that direction. The impartial seeker of the truth, however, must take into consideration any other factors which bear on the situation, and obviously the most important consideration in studying international trade is the trend of commodity prices throughout the world.

In the accompanying chart is a "barometer" showing the general trend of commodity prices in England, and since England is a free-trade market and the center of international commerce, we believe it is the best index of the trend of international trade obtainable, representing an average of about 100 articles of commerce. It shows that from 1909 until 1913 the worldwide trend of trade and prices was strongly upward. In the United States, however, Bradstreet's price index shows that business and prices in this country were on the decline during 1910 and 1911; consequently, if the Democratic tariff had gone into effect in 1910 or 1911, when business was expanding in Europe and declining in the United States, our exports would have gone on increas-



EUROPEAN BAROMETER OF TRADE AND FINANCE

ing, owing to the fact that Europe offered a better market than the United States from the standpoint of values, and, although the lower duties would have tended to increase imports, our trade balance would have shown an increasing tendency regardless of tariff legislation owing to the world-wide trend of trade at that time. The chart also shows that from the beginning of 1913 until the fall of 1914 prices and business declined in Europe, and this fact was probably as important as the Democratic tariff in causing our imports to increase, for Europe was no longer offering high prices for goods, and the natural tendency was to dump European goods in the United States or any other country in which a market could be found.

But notice the trend of prices in England during the past few months. They have risen much faster than prices in this country, the result being that European manufacturers are finding a good market at home for most articles, and our American manufacturers also are taking advantage of the higher prices in Europe, the result being that, in spite of the Democratic tariff, our exports have increased faster recently than our imports.

As I have said before, however, we are all agreed that the tendency of lower tariff duties is to increase imports. My point merely is that the international trade situation is as important in determining the balance of trade as the tariff. An opinion which considers only one factor and excludes the other is biased and necessarily short-sighted.

Trend of Prices and Trade

But let us go deeper. What determines the trend of prices and trade? The answer is that the three most important factors are politics, crops, and the supply of investment capital. The first two differ largely in different countries, and their influence must be analyzed for each country separately. The money and security markets, however, are international affairs, and in making generalizations regarding the worldwide trend of trade, therefore, we submit that the most useful basis of judging the outlook is a chart indicating the supply of capital available for the promotion of new enterprises. And since corporations and individuals alike generally borrow a certain proportion of their investment funds from the banks when promoting new enterprises and buying securities, an index of the supply of banking funds throughout the world always shows us when there is an abundance of investment capital, or the contrary.

After charting the supply of banking funds in all the principal banking centers of the world, we find that the resources of the Bank of France always furnish a reliable index of the general international banking situation. Whenever this index of banking funds has indicated an abundant supply of capital, as in 1902, 1905 and 1909, it has been possible for American railroads to sell large amounts of bonds on advantageous terms and business in the United States has expanded. Whenever the supply of banking funds has fallen below normal, however, as in 1907, 1911, 1913, etc., the result has been that new construction work in the United States has been checked.

As we pointed out above, the supply of banking funds is not the only factor to be considered in judging business conditions, but we believe we have shown that in addition to studying the political outlook and the progress of the crops at home, it is equally important to give intelligent attention to the trend of foreign trade and the supply of capital funds in Europe in order to arrive at a well-balanced conclusion.

The present war has brought home to every American business man and investor that his economic welfare is not dependent entirely upon local conditions, but that we are all part of a universal nation whose boundaries are as long and as broad as the earth.

WARREN F. HICKERNELL,
St. Louis, Mo. *Editor the Brookmire Economic Service.*

Opportunities for Manufacturers in Russia

To the Editor of the ELECTRICAL WORLD:

SIR:—In his letter in the ELECTRICAL WORLD of March 27 Mr. J. G. Koppel says that the electrical trade in Russia is concentrated to a great extent in the Baltic provinces where there is no need of the Russian language as the population of that territory speak German. He writes: "The most densely populated parts of Russia, starting from the Gulf of Finland, are the cities of Reval, Riga, Windau, Libau and Mitau. Most of the people are of German and Scandinavian descent and prefer to talk German rather than Russian. The people living between Mitau and Warsaw are of Lithuanian and Polish descent and do not like to talk Russian at all, because they hate Russians and the Russian language, so that one must use German if he wishes to transact business with them."

Mr. Koppel's statement is both inconsistent and untrue. The population of the Russian Baltic provinces is composed of Esthonians and Letts, the one a Mongolian, the other an Arian race. About 7 per cent of the population in the towns of the Baltic are German, and even they are mostly either Esthonians, Letts or Germanized Scandinavians. No people of Scandinavian descent live in the above-named provinces of Russia. The language in Reval, Dorpat and Pernau is Esthonian and that in Riga, Mitau, Libau and Windau is Lettish—languages which have no relation whatsoever to German.

Changes in the Language

It is true that a handful of German nobility is still trying to maintain a hold on the administrative power of the provinces which they obtained through their clever influence at the Russian court. The official language in the courts and higher schools is Russian. The University of Dorpat and the other colleges of the provinces, which were German some half a generation ago, are now Russian. I myself am a graduate of the old German system of schools in Dorpat. The educated classes of the Baltic provinces, such as the merchant and industrial class, speak not only the native tongue—either Esthonian or Lettish—but also German and Russian. Some fifteen years ago in the Baltic provinces there was a bitter feeling against the Russian bureaucracy, but never against the Russian people. On account of their higher education the Esthonians and Letts are more patriotic than the real Russians. The school system of the Baltic provinces surpasses that in many west European countries. The people in the towns mentioned by Mr. Koppel are good linguists and speak three languages. They understand Russian and carry on an extensive trade with the central Russian provinces. Mr. Koppel states that business can be conducted in the German language, but I know that Russian will be needed also. All of the official institutions are Russian.

I fully agree with Mr. Koppel that the best locations for securing the Russian electrical trade are Riga and Petrograd, and perhaps also Reval. My urgent advice to the American manufacturers who wish to do trade with Russia is to use the Russian language and have their catalogs printed in Russian.

IVAN NARODNY,
New York, N. Y. *Managing Director Russian Chamber of Commerce of America.*

ELECTRICAL INDUSTRY IN ENGLAND

All Manufacturers of Generating Apparatus Working at Full Pressure—Camps Are Electrically Lighted

BY HAYDN HARRISON, ELECTRICAL ENGINEER, LONDON

Since I wrote my last article on the subject of the electrical industry in this country [published in the ELECTRICAL WORLD of Jan. 2, 1915—ED.], war has more and more affected every industry over here. Lord Kitchener's call for men resulted in all classes flocking to the colors, so that engineering shops, factories, generating stations and all employers of labor found themselves short-handed. The first feeling was one of relief in many cases, as it had been realized that there would be serious trouble from want of employment. This feeling did not last long, for it soon became apparent that the demand for munitions of war would have to be supplied largely from this country.

The "War of Engineers"

This war should be known as the "war of engineers." Germany's engineers had been making preparations by which they were able to bring every improvement suggested by science to the assistance of the army and navy of their country, and at the commencement of the war it soon became apparent that they were better equipped with modern armaments than the allies to whom they were opposed.

This has had to be righted largely by the engineers of this country. Workshops and factories of all classes have had to abandon their ordinary operations and work at high pressure to produce some accessory necessary to carry on a successful campaign under modern conditions, and it is fortunate that, as a maritime nation, most of our engineers are of a class accustomed to a great variety of work.

Naturally, large shipbuilding works and arsenals have been pushed to their utmost capacity, and when the history of the war is written it will be found that the output of these works under emergency conditions has been of an almost incredible extent. Dreadnaughts, which would have been completed possibly in twelve months' time under ordinary circumstances, have been finished, fully equipped and quietly launched upon the water, and are now doing their work elsewhere. Submarines, torpedoes and other naval craft have been produced and are being produced at a wonderful rate, and the electrical machinery for these is keeping many of our factories working night and day.

The aircraft which form the new element in the war and which have proved so valuable for scouting and for range-finding in long-distance artillery work have been and are being manufactured in large numbers, and it is a striking fact that these machines are now produced with a certain knowledge that they will carry out efficiently the work for which they are intended.

But the greatest demand of all is for artillery, ammunition and the other requirements of our new army. Two million men from this country alone are now either on their way to or ready for the front, in addition to those who are already fighting there. The arming of these men, in addition to assisting our allies with arms and ammunition, has indeed thrown on the engineers of this country a task which at one time would have appeared impossible of execution, but it has been and is being carried out at a rate of which every Englishman has a right to be proud.

Some conception of the pressure which is put upon the factories can be gathered from the fact that in Birmingham, one of the largest centers of production of small accessories, the demand for electrical energy for workshops has become so great that a new temporary generating station is being put up. In Manchester similar extensions have proved necessary, and the same applies all over the country.

All the makers of electrical generating machinery are working at full pressure, most of the stock of machines suitable for military or naval purposes having been commandeered by the government at the start. Incidentally motor-vehicle manufacturers are being called upon for outputs far in excess of the normal, the demand being for heavy chassis of the very best construction, which are provided with suitable bodies for the conveyance of men, food and ammunition, and immediately shipped off to the front for the purposes of army transit.

The housing of the hundreds of thousands of troops under training has necessitated the erection of camps all over the country. These camps are put up on more permanent lines than is generally realized. Nearly all of them are lighted by electrical energy, and in many cases generating stations have had to be erected. Practically all the wiring contractors and wiremen in the country who have not joined the forces are on this work, and all the cable, accessories and electrical fixture makers are working at high pressure to produce the necessary apparatus.

This class of work is not in any way special and therefore can be conducted under existing organizations, but the production of shells and other munitions of war has of necessity been increased to such an extent that a great many factories and workshops have had to cease their ordinary work in order that the tools may be given up to the production of this particular class of material. The government has taken powers by which it can commandeer whole works for production of special articles and is in fact making use of works in this way.

The consequence is that works still free to manufacture electrical appliances are very full, despite the fact that, where possible, electrical undertakings are postponing any extensions until such a time as money can be spared for the purpose more easily.

Increase in Cost of Coal

The shortage of labor at the collieries and the congestion of the railways by military transport has led naturally to a large increase in the cost of coal delivered at electrical works, and this, of course, applies equally to gas works. This increased cost of coal is necessitating modifications in charges for electrical energy, and in many cases the gas companies have already raised prices by 10 or 20 per cent. As a rule, however, the electrical undertakings are holding back, pending developments. No doubt the effect that this will have on the balance sheets of electrical supply concerns will be considerable, especially in those cases where a cheap energy supply forms the bulk of the units delivered. It is worthy of note also that this form of supply has increased, whereas, owing to restrictions which have been instituted as a protection against the enemy's aircraft, and which apply both to private and to public lighting, the higher-priced units for lighting purposes have decreased.

Considering the congested condition of our factories and workshops due to the War Office and Admiralty work, it is not surprising that there is a falling off of exports. As anticipated, the imports from the United States have increased rapidly and in December had reached a value which nearly equaled the highest ever reached from Germany.

The electrical industry in this country is therefore in a state which is unique and cannot be compared with any previous state. In reality it is among those industries that are concentrated at the rear of the great army.

Enlargement of New York Interborough Station

One-half of Seventy-fourth Street Station, Supplying Electricity to Elevated Railroad, Remodeled, Increasing Rating 300 Per Cent

ON account of the prospective increase in the demand upon the generating plants of the Interborough Rapid Transit Company in New York due to the third-tracking of the elevated lines, the Seventy-fourth Street station is being remodeled. The changes are now approaching completion, two out of three new 30,000-kw turbo-generator units being in operation and carrying all of the load except during the peaks, when the remaining 7500-kw turbine and four reciprocating engines are sometimes called upon for assistance. One unit, shown in Fig. 1, is quite complete, and the second, while assisting in carrying the load, is undergoing an exhaustive series of tests. The foundations for the third unit are under construction.

The remodeling, which is being done with a view to the ultimate installation of a total of eight 30,000-kw units, is being carried on within the original building. For the present it involves principally the substitution of three turbine generators for four engine generators (see Figs. 2 and 3); the making over of one-half of the boiler plant opposite the turbines by replacing Roney stokers with Taylor underfeed stokers, adding superheaters and removing the economizers; the partial replacement of motor-driven triplex with turbine-driven centrifugal boiler-feed pumps, and the complete rearrangement of the electrical switching system with the addition of current-limiting reactors.

The Old Station

The old generating station, built 1901, was the model steam power plant of that time. Its equipment comprised eight Reynolds Allis-Chalmers double, horizontal-vertical, cross-compound engines of 12,000-hp actual or 8000-hp normal rating each, driving 11,000-volt revolving-field Westinghouse alternators, the largest that were ever built up to 1901. Each engine unit was essentially two separate compound engines at the ends of the shaft, each having a 44-in. high-pressure cylinder and an 88-in. low-pressure cylinder and of 60-in. strike, the speed being 75 r.p.m. By the 135-deg. setting of the cranks eight impulses per revolution were obtained.

The revolving weight on the bearings of each of the engines was 439,000 lb., and an allowance of 70,000 lb. more was made to provide for magnetic pull between field magnet and armature. The shaft itself weighed 63,000 lb. On account of the great mass of the revolving field magnet it was possible to dispense with the flywheel, a notable advance in slow-speed generating-unit design. To these engines was later added a 7500-kw Westinghouse turbine unit.

The engines exhausted into Worthington jet condensers with triplex motor-driven circulating pumps. They were so changed about 1903 by conversion to the barometric type.

The boiler house consisted of a basement, two boiler floors, and a row of coal bunkers, the height from the basement to the top of the monitor being 128 ft. The basement was divided into three longitudinal compartments for the purpose of protecting the pumps from the dust produced by the ash-handling machinery. On each boiler floor were thirty-two B. & W. boilers, with Roney stokers, each rated at 520 nominal hp and containing 5200 sq. ft. of heating surface. These were arranged in batteries of two, eight boilers to an engine and forming one complete generating unit. The boiler house was provided with four Custodis brick stacks of 17-ft. flue diameter at the top and 18-ft. at the bottom, 278 ft. high above the basement floor, the tallest stacks of the kind constructed in this country to that time. A Green economizer was provided for each four boilers, as it was deemed necessary to have these to heat the feed water, all of the auxiliaries being electrically driven. Each unit was served by an electrically driven Goulds triplex boiler-feed pump. Above the boiler floors was a row of three coal bunkers, separated by 35-ft. spaces for fire protection, having a total capacity of 7500 tons, a ten-day supply.

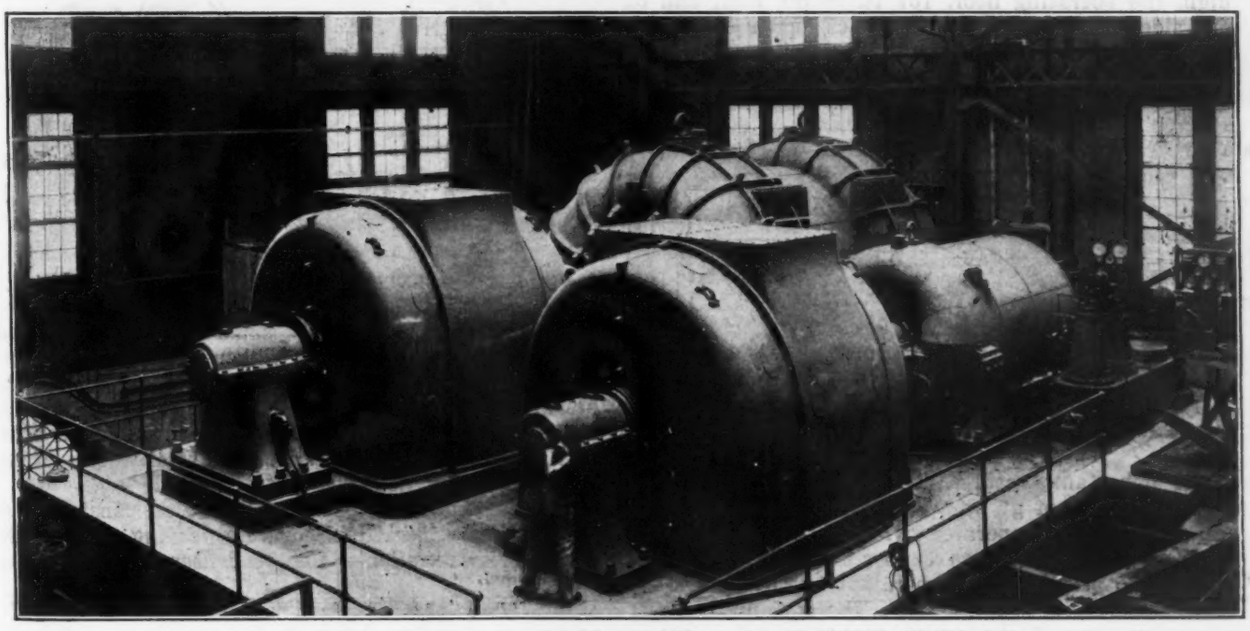


FIG. 1—NEW TURBINE UNIT OF INTERBOROUGH RAPID TRANSIT COMPANY

The building housing this generating plant extends from Seventy-fourth to Seventy-fifth Street along the East River, with a width of 204 ft. 4 in. and an average length of 404 ft. It is divided by a longitudinal wall into engine and boiler houses, respectively 93 ft. 6 in. and 104 ft. 2 in. wide. The basements of these are on the same level, 4 ft. 6 in. above high water

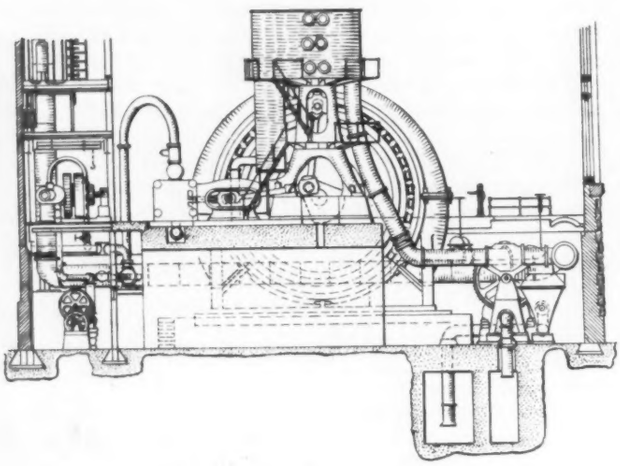


FIG. 2—CROSS-SECTION OF ENGINE ROOM BEFORE REMODELING

and 2 ft. 6 in. below Exterior Street, which lies between the plant and the river. Extending across the west end of the building is a vault 18 ft. wide divided into two parts, one for oil storage and the other for switch-control storage batteries. The roof of this vault serves as a roadway from street to street on the level of the lower boiler-room floor.

The coal and ash handling plant consists of two towers on the river bank for unloading coal and storing ashes, connected by bucket and belt conveyors with the power plant, distributing and collecting in the manner now standard in such plants. A feature of the tower design was the provision for hoisting coal from barges with a 1½-ton shovel just high enough to give the fall necessary for passing it through the crushers and weighing hoppers.

In the engine house were the basement, 21 ft. 6 in. high, the operating floor, 107 ft. to the roof, and on one side three switchboard galleries, under the lowermost of which the engine-driven exciter sets were placed. A 50-ton electric crane traversed the length of this house.

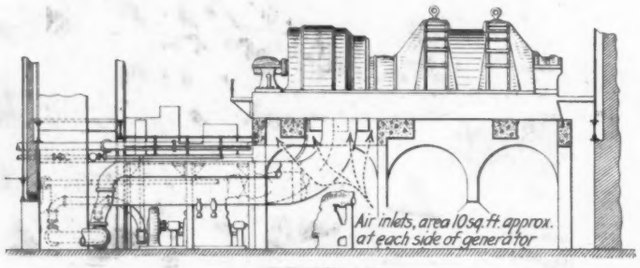


FIG. 3—CROSS-SECTION OF ENGINE ROOM AFTER REMODELING

The important features of the switching apparatus were the layout of group switches and the use of General Electric motor-operated switches. There were two complete sets of busbars connected by bus junction switches to permit of the operation of the alternators in either two or four batteries. The feeders from one substation formed one group controlled by a group switch in addition to the individual feeder switches. On the benchboard dummy busbars were placed to give the operator a graphic representation of the connections.

The Power Plant of 1915

The changes noted in the second paragraph, together with incidental changes, will be discussed in the order therein followed. The turbines, fully lagged, will appear as shown in Figs. 1 and 3. They have been rather fully described in the technical press so that only a few salient features need be mentioned. Each cross-compound unit consists of two turbines, a 1500-r.p.m., single-flow reaction turbine, and a 750-r.p.m. double-flow reaction turbine connected as a compound machine with a large receiver between elements. This novel arrangement was chosen to simplify design problems, particularly those relating to temperature range, blade speeds and steam congestion. At the same time the

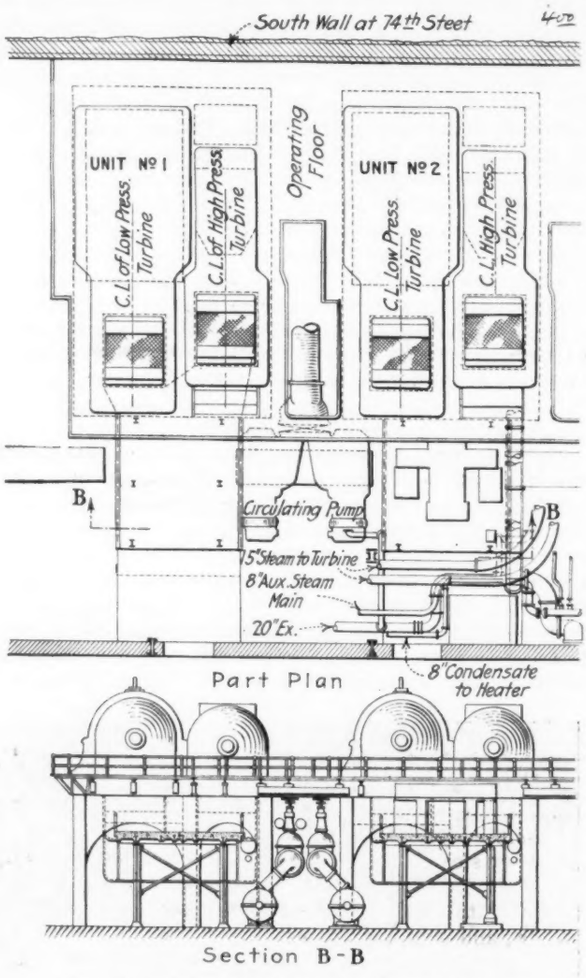


FIG. 4—GENERAL LAYOUT OF TURBINE UNIT

reliability of comparatively small units was secured. The efficiency guaranteed is higher than any heretofore obtained. Taking the amount of heat available in the steam between the conditions of admission and exhaust as a basis, the engines will deliver in electrical form 75.75 per cent of this energy. The total weight of the complete unit is 1,500,000 lb.

The turbine rests upon a foundation consisting of a steel frame incased in concrete, leaving most of the space below available for condensers, receiver and pumps.

The Worthington surface condenser, of 50,000 sq. ft. cooling surface for each unit, is of the twin-shell type,

of simple construction and practically self-contained. The tube arrangement is as shown in Fig. 5, passages being provided by "gashing" to give the freest possible access of the steam to the tubes. The condensers are hung directly from the turbine bedplates, a novel arrangement but one conducive to the elimination of stresses due to temperature changes. The weight of

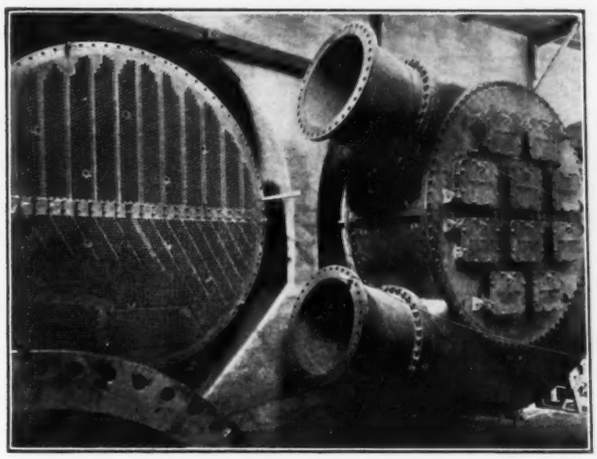


FIG. 5—CONDENSER AND SECTION OF PIPING

the condenser is, however, not carried by the turbine foundation, but upon a number of spring jacks, adjusted to share the load properly. The receiver is a vertical cylinder, of 7 ft. 9 in. inside diameter and 21 ft. long inside, placed symmetrically with respect to the condenser shells as shown in an accompanying plan. This is as large a receiver as could be accommodated in the available space.

Below each condenser shell and forming an integral part of it is a sump 4 ft. in diameter and about 4 ft. high, into which the condensate drains. This is designated as a "hot well" on the drawing, but there is no hot well in the new plant, using the term in its usually accepted sense, that function being performed by the feed-water heater.

The piping to and from the condenser is of unusual construction, designed to minimize the number of bends. As shown in Figs. 5 and 7, the water enters the condenser at the bottom through a 60-in. pipe, which dips under the nearer shell to reach the farther one. A baffle inside deflects a share of the circulating water into its proper channel. A similar outlet pipe above takes care of the discharge flow. This is the simplest possible piping layout for a twin-shell condenser. Short rubber sleeve expansion joints are inserted in the intake and discharge pipes near each shell. These joints consist of tubes of ½-in. five-ply-insertion rubber, 12 in. long and of 42-in. and 60-in. inside diameter, each clamped between an outer flange and an inner ring.

Circulating water for each pair of condensers is supplied, as shown in several illustrations, through a pair of tri-rotor centrifugal pumps having a combined capacity of 75,000 gal. per minute. These discharge through separate motor-operated gate valves, the discharge pipes uniting beyond the valves. The full capacity of the pumps will be required in summer when the circulating water temperature is high, but one pump will be sufficient in winter.

The pumps are driven by steam turbines rated at 240 hp each. The pumps draw from a new tunnel 12 ft. 6 in. by 12 ft. 6 in. in section. They discharge into two tunnels, one 8 ft. 6 in. by 12 ft. 3 in., and one 5 ft. by 12 ft. 3 in., which is the combination of the original intake and discharge tunnels. These will supply condensing water for eight units. The mouth of the intake tunnel is about 150 ft. upstream from the nearer discharge tunnel. New motor-driven revolving screens of the type shown in one of the illustrations have been installed near the river end of the intake tunnel, the driving motor being housed in a small building at the right, not shown. The screens are rotated for cleaning purposes daily. The location of the condensers with respect to the river level makes it possible to circulate the condensing water readily, the power required being only that necessary to overcome a small amount of friction, principally the friction head of the condenser and piping.

The condensate pumps for each unit are of the centrifugal type, turbine-driven and of 800-gal. per minute capacity each. One pump is sufficient, the second being a reserve. One reciprocating dry-vacuum pump is provided for each unit, with a capacity for two. The vacuum pumps are cross-connected between units.

The general turbine-room piping scheme is shown in Fig. 8. It comprises duplicate 15-in. mains for the turbines and 8-in. auxiliary mains, all suspended overhead in the basement, and provided with long radius curves and goosenecks where necessary. Twelve-inch condensate lines unite in a 16-in. main to the heater, as do 28-in. exhaust lines into a 36-in. main. The illustration shows the essentials of one unit with the exception of the atmospheric exhaust, an important feature on account of the large sizes of pipe involved.

This atmospheric exhaust system is combined with the auxiliary exhaust in the following fashion: From each receiver is a 30-in. line into which the auxiliary exhaust lines are connected. An atmospheric relief valve is in each line near the receiver. This is a standard relief valve weighted to open on about 28 lb. per square inch absolute pressure by means of a hydraulic piston and standpipe accumulator. The three lines lead into a tapered header, from which two 30-in. risers, sealed with back-pressure valves, extend above the roof. From the header a 42-in. pipe leads to the feed-water heater. This is also protected with a riser and valve.

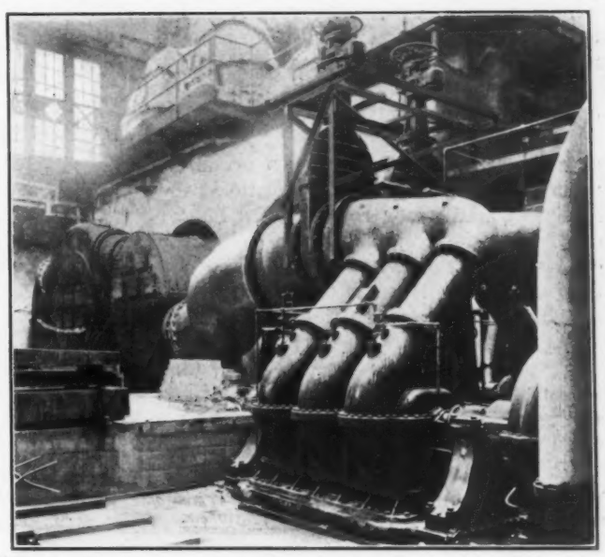


FIG. 6—TRI-ROTOR CIRCULATING PUMPS

Between the receiver and the feed-water heater is a "thermal" or "heat-balance" valve for equalizing the distribution of heat in the system. This valve is shown in cross-section in Fig. 10. Its function is to bleed steam from the receiver into the heater when there is a deficiency of supply to the latter from the auxiliaries, or vice versa. At about 27,000 kw the receiver pres-

sure reaches atmospheric pressure, continuing to rise until at 32,000 kw it is about 3-lb. gage.

In the figure the left-hand opening in the chamber leads to the heater, the right-hand one to the receiver. There are two piston valves, *A* and *B*. When heater pressure is above atmospheric, the latter being applied to the upper side through a pipe connection, *A* rises and bleeds steam through port *C* to the receiver. Whenever the receiver pressure is higher than that of the heater, *B* rises, admitting steam through port *D* to the heater. A dashpot at the top of the upper valve chamber prevents sudden acceleration of *A*, and through *A* provides a cushion for *B*. In action the valves do not lift very high off their seat.

Above the valve is an auxiliary cylinder *E* with live steam above its piston and with pressure controlled by the turbine automatic stop governor below. The piston is loosely packed and leaky and ordinarily floats. When the automatic stop governor operates, pressure is reduced below the piston, which is forced down, restoring *A* and *B* to the position shown and cutting off connection between receiver and heater.

Another valve which has been developed by the company's engineers is one for shutting off the supply of steam in case the vacuum falls below a predeterminate value. It consists of a float, the level of which is controlled by the height of a mercury column connected to the condenser. The valve is adjusted to trip the pilot valve of the actuating piston on the main throttle when the vacuum falls to, say, 15 in.

In the boiler house the original boilers are being retained, but one-half are being rebuilt to the extent of adding standard B. & W. superheaters to give 200 deg. of superheat when the boilers are delivering three times their rated output. The Taylor underfeed stokers which are being installed under one-half of the boilers are standard, but on four of the boilers air tuyères have been installed along the side walls, directing jets over the fires and protecting the side walls.

One Hoppes open-type feed-water heater, 9 ft. in diameter and 21 ft. long, with a capacity of 1,600,000 lb. per hour, has been added to do the work of the displaced economizers, there being now a good supply of steam from the turbine-driven auxiliaries. It contains 240 pans, each 4 ft. long, having a total area of 3400 sq. ft. In this heater the surplus heat is being absorbed to such an extent that an occasional gentle puff of steam from the relief valve on the heater indicates how little heat is wasted in this part of the system.

As the remodeled boiler plant provides only superheated steam, provision had to be made for the auxiliary supply of saturated steam for the reciprocating engines. In the line connecting the old and new boiler plants is connected a receiver from one of the old engines. This is placed in a vertical position, and the superheated steam is led in at the top, passing downward nearly to the bottom through a 15-in. tube. Near the top water is sprayed into the steam through a spraying nozzle, the surplus collecting in the bottom, whence it is returned to the water system. The wet steam rises in the space between the tube and the casing, drying as it rises, and saturated steam is taken off near the top. This device is known as an "attemperator"

In the boiler-room basement much space has been saved by the removal of four triplex pumps, accommodating three turbine-driven centrifugal pumps sufficient in capacity for the entire plant and the stoker fans and turbines. For each pair of boilers there is one turbine driving two stoker fans direct and the stokers also through helical reduction gears from the blower shafts. In the basement ashpits of expanded metal plastered with cement have been recently put in.

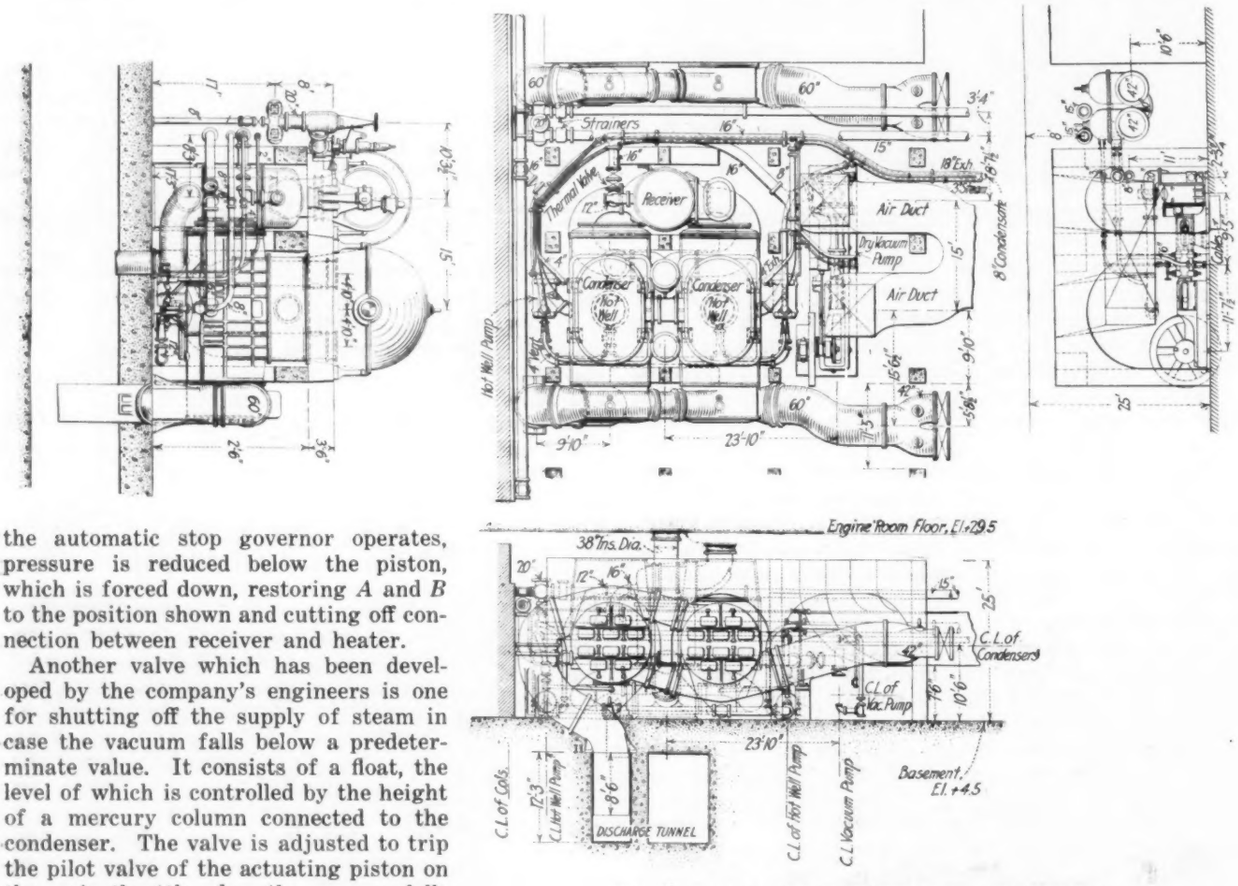


FIG. 7—PLAN AND ELEVATIONS OF CONDENSER

The electrical distribution of the plant has been entirely remodeled with a view to providing adequately large switches, feeders, etc., and to protecting the underground cables from damage due to the large amounts of energy which will now be concentrated on short-circuit. There are two sets of buses, main and auxiliary, to which each old and new generating unit is connected. Between the generator and the main bus is a reactor with 5 per cent reactance, and between it and

the auxiliary bus is one with 2 per cent reactance. The main bus is sectionalized through oil switches, groups of feeders being taken off from each section.

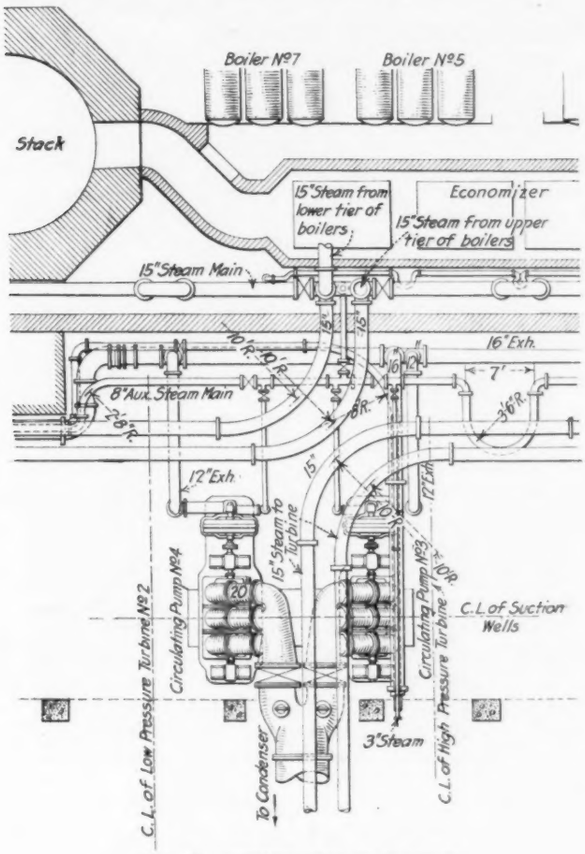


FIG. 8—PIPING FOR ONE UNIT

The reactance coils are mounted on the exciter gallery, conveniently placed with respect to the generators. The 5 per cent coil is about 4 ft. 6 in. in diameter and

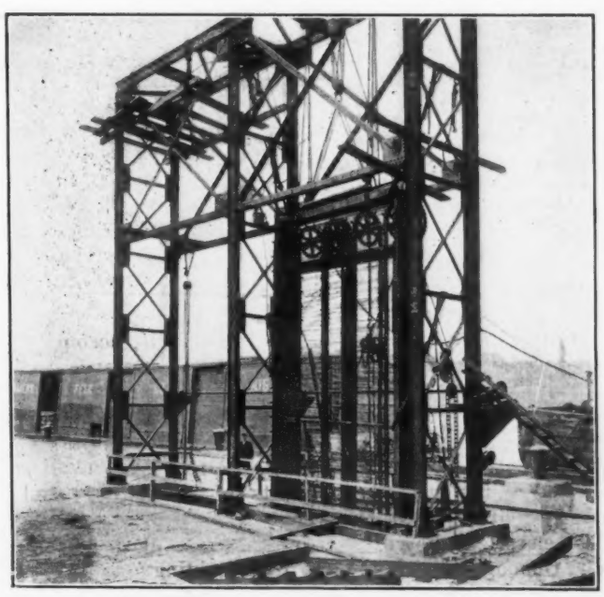


FIG. 9—REVOLVING INTAKE SCREEN

8 ft. 6 in. long, and the 2 per cent coil is about 4 ft. 6 in. in diameter by 3 ft. 6 in. long.

The oil switches are of standard General Electric manufacture, type H6, with 10-in. pots.

The generators have been designed for their rated output, 30,000 kw, with 55 deg. C. temperature rise. They are ventilated by means of fans which form part of the revolving field. The air is taken in through

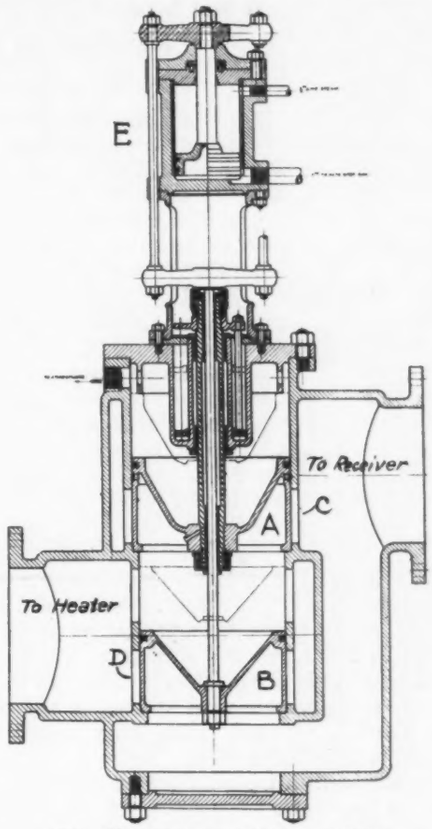


FIG. 10—HEAT-BALANCE VALVE

four inlets under the bedplate (see Fig. 3), and it is discharged through ducts to the boiler house, where it eventually reaches the fans. The generators have about 8 per cent reactance, and the armature windings are braced with extraordinary firmness to withstand the mechanical effects of short-circuits.

The changes described in this article were designed and carried out by the engineers of the Interborough Rapid Transit Company, under the direction of Mr. Henry G. Stott, superintendent of motive power. Those in responsible detail charge were Mr. Reginald J. S. Pigott, mechanical-construction engineer, and Mr. Gaylord C. Hall, electrical engineer.

Comparative Values of Increasing Vacuum and Steam Pressure

An ideal or perfect engine operating with a steam pressure of 150-lb. gage and a condenser vacuum of 24 in. of mercury can transform into mechanical energy only 23.7 per cent of the heat in the steam it receives (Technical Paper 80, Bureau of Mines). If the vacuum is increased to 28 in., other conditions remaining the same, the percentage of heat available for conversion is 28.8 per cent. If the vacuum is maintained at 24 in. and the steam pressure increased from 150-lb. to 200-lb. gage, the percentage of heat available for conversion into mechanical energy will increase from 23.7 per cent to 25.3 per cent. This shows that increasing the vacuum is more effective than increasing the steam pressure, but combinations of both will have still more desirable effects. To maintain a high vacuum, however, requires that considerable cooling water be available.

Special Structures for Electric Lines

How the Necessity of Transposing Circuits, Supporting Switches and Transformers and Crossing Obstructions Is Met

BY R. D. COOMBS

IN addition to the regular structures employed to support transmission and distribution lines, special structures have to be provided frequently for transposing circuits, for supporting outdoor switching and transformer equipment, and for crossing obstructions.

Unusually high towers have to be employed occasionally at river crossings or where very long spans stretch over irregular hilly ground. The United States government specifies minimum clearances of 120 ft. over small rivers and 150 ft. over deeper waterways. If high towers are used to support wires, a reasonable percentage of which are not liable to be broken, the towers need not be self-supporting but may be guyed. When only a small number of wires are supported it is feasible to dead-end a tower, but if a number of heavy lines are employed it would require a massive structure or considerable guying.

High Towers

In Fig. 1 is one of the heaviest overhead river crossings in this country. The structure was not designed to dead-end all of the wires under 0.5-in. ice and 8-lb. wind load, but will withstand the maximum transverse loading combined with some unbalancing due to broken wires. Since the normal wire tension is approximately only one-third of the maximum, they would probably withstand normal dead-ending. Some additional security can be afforded in installations of this kind by using longitudinal guys away from the river. In the crossing shown the rise from the normal elevation to the crossing elevation is abrupt, there being no grading-up by the adjoining supports, and consequently only two high towers are required for the crossing.

Pin insulators, unless equipped with a saddle, are not adapted to supporting steep approach conductors because the wires would not clear the petticoats. The most satisfactory supports for such installations are strain insulators. If care is not exercised in balancing the tension in the crossing and adjoining spans, high towers will be subjected to heavy loads and suspension insulators will be noticeably inclined from the vertical. When the crossing span is much longer than the approach spans, as is frequently the case, the wires in the inclined span will have small sags and may therefore be brought closer together on the low pole than they are spaced on the crossing. All high towers should be provided with overhead ground wires and ladders and should be grounded below the foundation. As these structures are relatively heavy it is more economical to paint them than to use galvanized material.

Aerial Cable

In some instances where an overhead line must cross territory subject to restrictions, and particularly when adjacent to submarine or duct lines, an aerial insulated cable system has been used. This arrangement is practicable only for pressures below 22,000 volts, since satisfactory insulated cable is not obtainable for higher voltages. In the installation shown (Figs. 2 and 3) the cables are hung from steel messengers and supported on a low line of closely spaced poles. Short, heavy poles are employed, guyed at corners and ends but not designed for unbalanced loads caused by broken messengers or cables.

Another type of aerial duct line for 13,000-volt three-

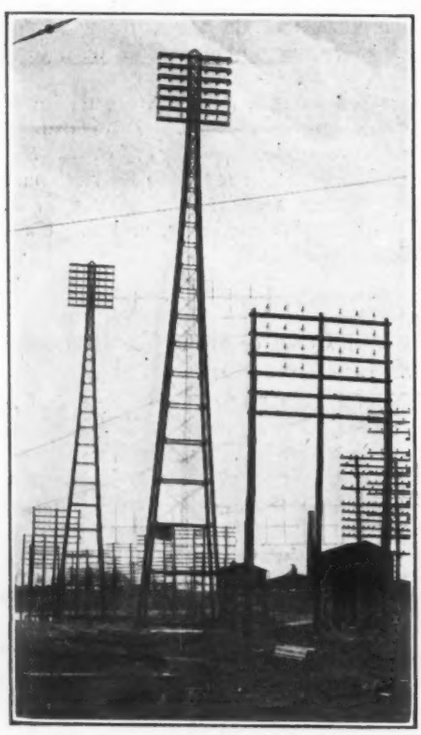


FIG. 1—SEMI-DEAD-END TOWERS SUPPORTING OPEN WIRES

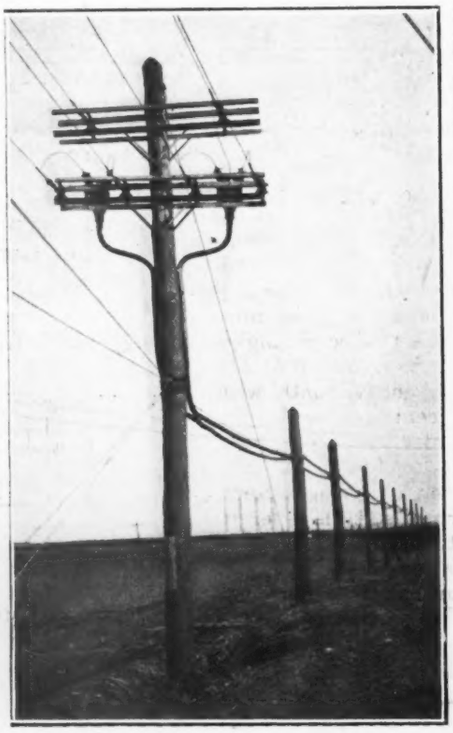


FIG. 2—JUNCTION OF OPEN-WIRE AND CABLE TRANSMISSION CIRCUITS

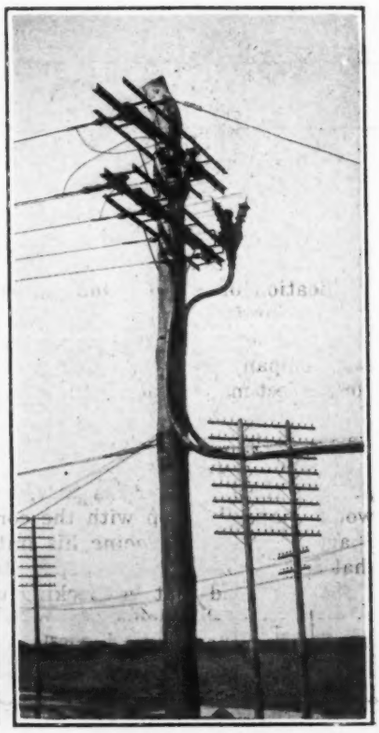


FIG. 3—POT-HEAD CONNECTION TO AERIAL CABLE

wire cables is shown in Fig. 4, in which the split-metal tubes inclosing the cables are supported on brackets riveted to stiffeners on a bridge girder. This construction was employed because the circuit had to cross two

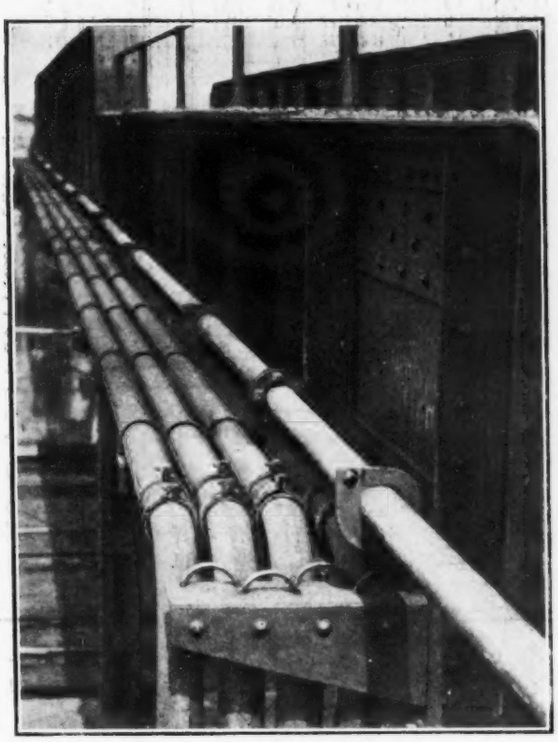


FIG. 4—CONDUITS CONTAINING 13,000-VOLT CIRCUITS

railroads, one heavy high-tension line on tall towers and several important telephone and telegraph systems.

In making such attachments to bridges the cables should be arranged so they will be accessible without interfering with other interests or being subject to injury by careless workmen.

Credits and Meter Readings Discussed

Before the New England Section of the N. E. L. A., Mr. L. D. Gibbs, Boston, recently pointed out the possibilities for co-operation between small central stations and local offices of the telephone company, particularly in connection with extending credits to customers. Department-store credit records are also worth looking into, to save duplication of effort. One company writes to the central station in a former place of residence when examining customers' credit. The Narragansett Electric Lighting Company, Providence, R. I., offers a reward of $10 for perfect meter reading through an entire month, with a reduced premium for a lower percentage of accuracy. Last month six premiums were paid.

One company emphasized the great saving of time possible if each meter installer, when removing meters, would mark the loop with the correct suite number in apartment houses, placing his initials upon the tag, so that in case of error the responsibility can be fixed. It has been found that in checking up meters under complaint a second or checking meter is sometimes more satisfactory than a test with a rotating standard or indicating wattmeter, as this method will show up incorrect clock gear ratio. The Providence company prepares plans and specifications in connection with wiring jobs, and at Worcester, Mass., the local central station installs electric motors free of charge.

CENTRAL-STATION BUSINESS IMPROVES

During First Half Year of Depression Utilities Increase Their Income by 4.75 per Cent

Data received by the ELECTRIAL WORLD from central stations show a larger percentage gain in income from the sale of energy for the month of January last than was registered in the three previous months. While not so large as that in December, the gain in output was appreciable.

The opening of the San Diego Exposition in January

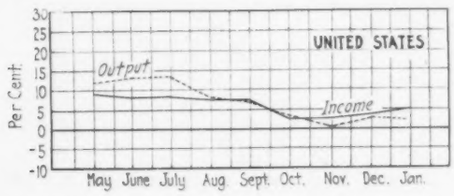
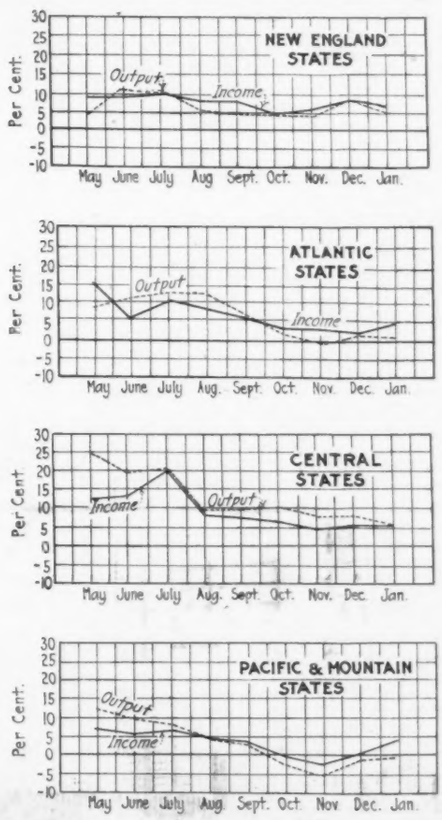


FIG. 1—CENTRAL-STATION INCOME AND OUTPUT GAINS BY MONTHS IN PER CENT FOR UNITED STATES

and the operations preliminary to the opening of the Panama-Pacific International Exposition have proved of benefit to the industry in the far West. The immediate effect was felt, of course, in California, where over one-half of the industry of that section is concentrated. The disproportionate increase in income compared with the increase in output was attributable largely to one large company in the Mountain district, which acquired at retail rates a very large load that it formerly carried



FIGS. 2 TO 5—CENTRAL-STATION INCOME AND OUTPUT GAINS BY MONTHS IN PER CENT SECTIONALLY

at wholesale rates. The new-business campaign on heating devices recently conducted in Denver is now having a beneficial effect, especially upon the income, as the energy for this purpose is sold at domestic rates.

The operations in the Central States did not show so

large a gain in January as in December. Those in the Northeastern section did very well on account of general business revival. In the South, however, stagnation in the cotton industry has had its effects upon everyone. The situation brightened somewhat late in January than in previous months, the effect was not sufficient to make itself favorably felt by the utilities. The long period of non-employment through which a large portion of the wage-earning population had passed and the recent holiday expenses had left them in a position where worse than strict economy was necessary. The railways suffered most, and the decrease in traffic load had an immediate effect in lessening the load on central stations, which supply most of the energy for railway purposes. The income of some companies was also reduced because of changes in rates.

In January was completed the first half-year of the European war and the accompanying depression in this country. During that time the income of the electric

TABLE I—CENTRAL-STATION RETURNS FOR NINE-MONTH PERIOD

	Percentage of Industry Represented	Income from the Sale of Energy			Kw-hr. Output		
		1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
1914							
May	45	$14,295,321	$13,099,007	9.1	674,877,591	602,832,337	12.0
June	45	14,073,840	12,996,198	8.3	682,791,096	603,122,008	13.3
July	40	14,086,822	12,970,325	8.5	735,937,850	649,720,026	13.3
Aug.	51	15,298,226	14,200,649	7.8	778,109,565	718,274,456	8.2
Sept.	51	15,708,695	14,694,205	7.0	782,450,267	733,754,420	6.8
Oct.	59	17,667,912	17,174,567	2.8	969,817,024	935,249,519	3.0
Nov.	65	19,777,650	19,260,451	2.7	986,456,324	978,934,946	0.8
Dec.	65	20,978,430	20,281,812	3.3	1,074,083,543	1,043,457,795	3.0
		1915	1914		1915	1914	
Jan.	65	21,577,377	20,584,393	4.8	975,800,748	959,652,581	1.7

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A NINE-MONTH PERIOD

	Month	Percentage of Industry Represented	New England States		Per Cent Increase	Percentage of Industry Represented	Atlantic States		Per Cent Increase	Percentage of Industry Represented	Central States (Illinois Excluded)		Per Cent Increase	Percentage of Industry Represented	Pacific and Mountain States		Per Cent Increase
			1914	1913			1914	1913			1914	1913			1914	1913	
INCOME	May	55	$1,745,160	$1,609,234	8.4	58	$6,492,767	$5,628,718	14.5	43	$3,200,553	$2,841,685	12.7	57	$1,525,729	$1,426,885	7.0
	June	58	1,560,872	1,442,178	8.3	54	6,067,780	5,578,311	6.0	52	3,914,836	3,459,497	13.2	67	1,894,887	1,791,918	5.8
	July	60	1,670,819	1,530,410	9.2	54	6,152,169	5,583,309	10.2	52	3,802,126	3,307,719	15.0	72	2,212,827	2,068,249	6.8
	August	61	1,734,583	1,607,649	7.5	55	6,224,896	5,755,515	8.2	57	4,389,696	4,051,678	8.4	75	2,386,677	2,282,061	4.6
	Sept	61	1,766,587	1,647,945	7.3	55	6,608,221	6,221,000	6.1	57	4,704,780	4,368,251	7.9	75	2,487,513	2,398,176	3.7
	Oct	64	1,963,579	1,889,255	4.0	67	7,451,220	7,232,063	3.1	57	5,105,810	4,783,847	6.8	85	3,146,160	3,157,689	0.3*
	Nov.	67	2,220,742	2,115,957	5.6	69	8,373,772	8,157,966	2.7	57	5,408,672	5,158,981	4.8	88	3,503,499	3,574,086	2.0
	Dec.	67	2,385,711	2,218,387	7.5	69	8,765,275	8,594,773	2.2	57	5,992,542	5,654,740	5.9	88	3,834,902	3,813,912	0.3*
	Jan., 1915	67	2,423,795	2,271,881	6.8	69	9,075,335	8,695,593	4.4	57	5,827,997	5,525,579	5.4	88	3,955,438	3,804,341	4.0
KW-HR. OUTPUT	May	55	52,752,247	50,779,103	3.9	58	259,098,542	238,733,320	8.4	43	202,611,026	162,363,929	24.8	57	144,839,552	129,357,915	11.9
	June	58	53,463,013	48,049,756	11.1	54	244,936,886	221,315,464	10.8	52	217,920,183	182,406,207	19.4	67	155,326,455	141,836,377	9.6
	July	60	54,074,533	49,255,893	9.8	54	263,580,290	235,068,939	11.8	52	217,928,950	188,569,581	15.6	72	183,160,015	169,718,387	7.9
	Aug.	61	55,801,224	52,913,483	5.4	55	264,717,319	237,984,895	11.2	57	267,501,400	226,276,638	9.4	75	193,216,699	185,330,705	4.2
	Sept	61	55,525,272	53,267,877	4.3	55	270,974,533	252,648,550	7.3	57	260,705,339	237,832,934	9.7	75	190,979,705	185,090,658	3.2
	Oct	64	67,520,070	65,068,938	3.8	67	358,458,539	351,362,247	2.1	57	295,490,712	266,827,567	10.5	85	245,966,868	252,047,828	2.4*
	Nov.	67	69,480,163	66,988,456	3.8	69	361,364,405	364,155,759	0.7*	57	290,681,750	269,220,528	8.0	88	255,651,947	269,467,354	5.1*
	Dec.	67	78,510,793	71,990,132	7.8	69	401,623,514	396,251,867	1.2	57	315,027,232	291,511,670	8.0	88	278,922,004	283,704,076	1.6*
	Jan., 1915	67	72,550,608	69,317,803	4.7	69	374,972,536	373,336,906	0.7	57	272,623,760	258,572,903	5.5	88	248,247,195	249,650,530	0.3*

*Decrease.

TABLE III—COMPARATIVE FIGURES FOR 51 PER CENT OF INDUSTRY OVER A FIVE-MONTH PERIOD

	Income from Sale of Energy			Kw-hr. Output		
	1914	1913	Per Cent Increase	1914	1913	Per Cent Increase
September	$15,708,695	$14,694,205	7.0	782,450,267	733,754,420	6.8
October	16,967,816	16,443,831	3.3	911,982,671	876,944,255	4.0
November	17,840,812	18,185,093	1.7*	804,960,227	780,632,582	3.0
December	19,122,288	18,446,438	3.8	875,707,036	850,606,834	2.9
	1915	1914		1915	1914	
January	19,731,452	18,790,526	5.0	857,083,808	838,239,391	2.2

*Decrease.

TABLE IV—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR UNITED STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January
INCOME:					
Group 1	8.0	4.2	2.6	2.6	2.7
Group 2	8.2	4.7	4.7	4.9	8.8
Group 3	4.2	1.2	0.5	3.3	2.4
Group 4	10.0	15.1	4.8	4.8	5.8
Group 5	9.1	3.5	1.5	3.2	4.5
OUTPUT:					
Group 1	5.5	3.2	0.5	3.1	3.9
Group 2	14.0	5.2	4.2	3.0	4.3
Group 3	2.7	4.6*	7.2*	6.8	1.2
Group 4	9.5	6.3	5.7	9.2	9.0
Group 5	4.0	2.9	2.6*	1.8	7.5

*Decrease.

TABLE V—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR NEW ENGLAND STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January
INCOME:					
Group 1	5.8	5.0	6.1	7.9	7.1
Group 2	6.3	2.3	2.3	5.5	6.2
Group 3	7.0	6.1	9.7	11.4	7.5
Group 4	3.9	5.8	9.0	8.2	8.9
Group 5	17.8	8.0	3.9	5.5	2.1*
OUTPUT:					
Group 1	2.0	4.2	6.9	12.5	6.3
Group 2	12.0	1.0	1.5*	5.9	5.4
Group 3	7.4*	6.6	7.5	11.0	1.2
Group 4	15.0	14.2	4.2	12.5	10.9*
Group 5	9.7*	8.1*	8.3*	4.1	9.0*

*Decrease.

the month, when an outlet for cotton was being found.

General business conditions throughout the Atlantic States during January did not show appreciable change, but there was an excellent increase in income on account of a larger domestic consumption. While industrial operations in general in New England were better

ultilities was $186,650,000, as compared with $178,250,000 in the same period in the previous year, a gain of $8,400,000 or 4.75 per cent.

Explanation of Curves and Tables

The accompanying curves show graphically the effect of the widespread industrial depression on the monthly percentages of increase in gross income and kilowatt-hour output. Tables I and II show the gross returns received by the ELECTRICAL WORLD. In Table III are shown comparative figures for 51 per cent of the industry, returns from the same companies being represented in each month. In the remaining tables percentages of increase of 1914 over 1913 are shown for companies grouped according to the size of the cities in which they operate. In group 1 are included cities of over 100,000 inhabitants; group 2, cities between 50,000 and 100,000; group 3, between 25,000 and 50,000; group 4, between 10,000 and 25,000, and group 5, between 5,000 and 10,000.

TABLE VI—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR ATLANTIC STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January
INCOME:					
Group 1	7.8	6.2	3.0	1.6	1.3
Group 2	6.1	7.1	2.7	3.9	5.0
Group 3	7.9	1.4	0.3*	0.4	3.3
Group 4	8.3	6.8	4.8	7.9	35.5*
Group 5	10.0	10.2	13.5	11.2	9.0
OUTPUT:					
Group 1	7.1	4.6	0.0	3.2	1.7
Group 2	15.6	10.3	5.0	4.3	3.1
Group 3	16 4	6.0*	8.5*	7.7*	7.4
Group 4	2.2	0.0	3.8	6.2	7.8
Group 5	26.8	46.5	57.5	11.1	13.5

*Decrease.

TABLE VII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR CENTRAL STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January
INCOME:					
Group 1	7.7	7.0	4.7	5.2	6 1
Group 2	9.5	4.7	5.2	7.5	4.3
Group 3	0.0	4.0	4.0	7 5	2.1
Group 4	11.3	8.1	4.3	6.4	3.6
Group 5	9.5	1.6	0.5*	1.5*	3.7
OUTPUT:					
Group 1	5.7	6.3	2.4	4.2	9.0
Group 2	21.0	11.2	14.8	12.4	4.8
Group 3	4.4	5.0	6.6	12.4	8.2
Group 4	14.7	7.8	8.3	13.3	8.4
Group 5	21.0	5.0	4.9	13.0	13.7

*Decrease.

TABLE VIII—PERCENTAGE RATE OF INCREASE IN INCOME AND KILOWATT-HOUR OUTPUT FOR PACIFIC AND MOUNTAIN STATES—CITIES GROUPED ACCORDING TO SIZE

	September	October	November	December	January
INCOME:					
Group 1	7.5	0.3*	2.4*	0.6*	1.0*
Group 2	13.1	2.0	1.1	1.0	145.6
Group 3	3.8	1.7*	3.5*	1.0	0.6
Group 4	17.7	2.9*	1.4	6.5	6.2
Group 5	4.4	0.1	3.1*	2.5*	1.8
OUTPUT:					
Group 1	2 3	1.6*	2.1*	0.0	1.5
Group 2	4.5*	13.0*	7.7*	13.0*	3.7
Group 3	2.7	7.3*	14.1*	14.2*	13.5*
Group 4	12.0	7.1	4.4	3.7	9.5
Group 5	7.2*	1.1	2.9*	1.0	4.1

*Decrease.

LONG-DISTANCE RADIOTELEGRAPHY

Discussion Before Joint Meeting of the A. I. E. E. and the Institute of Radio Engineers

At a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers held at the Engineering Societies Building, New York, on April 9, Mr. L. F. Fuller presented a paper entitled "Continuous Waves in Long-Distance Radiotelegraphy." Since the only certain uniformity possible in earth surface conductivity is that over sea water, and since it is only under normal day conditions that uniformity can exist, the author stated that the only relative uniform basis upon which theoretical and empirical formulas may be compared is for transmission over sea water under normal day conditions. After briefly considering the theoretical equation of long-distance radiotransmission for both continuous and damped waves and the empirical formula of Austin for damped waves, he stated that the Austin formula proves quite satisfactory for the ordinary calculations of practical work and would indicate that a change should be made in the theoretical equation to account for the considerable increase in received energy noted, seemingly due to convergence.

The paper contained a description of the San Francisco-Honolulu sustained-wave tests of 1914 divided into two parts, the first dealing with the effects of wave-lengths upon the strength of received signals, and the second covering the derivation of a proposed empirical formula for sustained-wave transmission. The plant of the two stations and the methods of taking data were also described. The experiments covered a period of six months, extending from January to June, 1914, inclusive, the range of wave-length being from 3000 meters to 11,800 meters and the distance of transmission 2100 nautical miles or 3880 km. A number of curves were presented showing the energy received at the two stations for different wave-lengths under both day and night conditions.

Having made calculations from data taken from the curves, the author determined the value of certain constants and arrived at the following empirical formula for daylight transmission for continuous waves over sea water:

$$I_r = 377\,\frac{h_1 h_2 I_s}{\lambda d R}\sqrt{\frac{\theta}{\sin\theta}}\cdot e^{-\frac{0.0045\,d}{\lambda\sqrt{2}}},$$

wherein I_r is the current in amperes at the base of the receiving antenna of effective height h_2 in kilometers and resistance R ohms, I_s is the current in amperes at the base of the sending antenna of effective height h_1 in kilometers, λ is the wave length in kilometers, d is the distance in kilometers, and θ is the angle at the center of the earth subtended by the distance d.

Further tests in November and December, 1914, from Tuckerton, N. J., to Honolulu, a distance of 4330 nautical miles or 8000 km, served to check this formula.

The following general conclusions were drawn from the above tests: (1) Under normal day conditions the comparative transmission efficiency of continuous waves is somewhat higher than that of damped waves on wave-lengths above 3000 meters. (2) The transmission efficiency of continuous waves generated by either a Goldschmidt reflection alternator or a Poulsen-Federal arc would seem to be the same. (3) In transmissions over distances of the order of 4000 nautical miles intervening land appears to be the equivalent of sea water, at least during the winter months. (4) Evidence is found adding weight to the theories of refraction upon certain wave-lengths. Very frequently, a wave-length used at Honolulu which is excellent at a certain station is useless at another station 9 miles away, and

as atmospheric conditions change conditions are reversed. This, the author states, plainly shows the interference bands to be not over 18 miles in width. (5) Ability to change wave-lengths rapidly is of the greatest value in long-distance radiotelegraphy.

In some introductory remarks, Dr. John B. Whitehead, chairman of the electrophysics committee of the American Institute of Electrical Engineers, said that, notwithstanding all the wonderful results which have been accomplished up to the present time, radio transmission remains one of the most fruitful fields of investigation and one in which the governing laws are probably less understood than in any other field of the application of electricity.

Discussion

In opening the discussion Dr. Alfred N. Goldsmith stated that the paper would be of valuable assistance in enabling one to proportion a transmitting set to the distance to be covered. He spoke about the incredible velocities of the waves and the high frequencies normally employed. In connection with the use of sustained waves certain new effects have become of interest and prominence, the first of which is that of the reflection or interference of the sustained wave. There is the development of new methods of reception, which have led to the introduction of the "tikker" commutator, which periodically discharges a condenser charged slowly by the incoming energy. He also spoke of the "tone wheel" used by the Goldschmidt company, a carefully designed commutator interrupting the incoming energy flow at a frequency slightly different from the incoming frequencies. This device finally led to the development of the method of reception known as the heterodyne system of receiving. Dr. Goldsmith laid emphasis on the fact that it has been possible to build arc transmitters that have now become satisfactory and reliable generators of considerable amounts of sustained energy flow. Those who have learned to work on the production of sustained oscillation should remember that the most important feature in the generator of this type is the possibility of rapidly changing the wave-length.

Mr. J. Zenneck pointed out that with the use of a rotary tikker the telephone current is not expected to be proportional to the square of the received current as shown in the paper, but rather proportional to the received current itself. The speaker stated that comparisons should be made only under the same conditions. The same wave-lengths must be chosen, the same atmospheric conditions be had, etc. Curves were presented showing the difference between the formulas used by Mr. Fuller and those used by Dr. Austin. Within the limit in which the results of the two were comparable the curves agreed very well, but on extending the curves of one and making comparisons with the other contrary results were noted.

Dr. Lee de Forest gave a brief account of the first observation of the interference bands and absorption and reflection.

Lieut.-Commander A. J. Hepburn stated that he believed a transmission theory rather than a transmission formula is needed, and that there is promise of most valuable progress for the establishment of a complete theory in a course of experimental work such as that which has been contemplated by the Navy Department for several years. The plan, not yet in operation, contemplates the use of the station at the Washington Navy Yard for transmitting and the station at the Bureau of Standards (6 miles distant) and that at Annapolis (23 miles distant) for measuring the received energy. Starting with the Austin formula as a trial basis, each separate factor would be independently investigated, as well as some other possibilities that do not appear in that formula, such as decrement and reflection.

Mr. E. F. W. Alexanderson stated that if a system for radio transmission is to be designed, in view of the knowledge we now have, it will be necessary to determine the frequency, or eventually the range of frequency, that is most favorable, the power necessity, and the voltage for which the aerial must be designed. Under certain conditions the lower limit of frequency may be determined by the feasibility of insulating against the maximum voltage. It would be very valuable for the design of apparatus for radio frequencies if some practical rule for the range of frequency that is most efficient should be given in addition to the general formula and theoretical considerations.

Mr. G. H. Clarke called attention to a test in which, on measuring the decrement of two transmitters of widely different efficiencies coupled to the same antenna and so adjusted that the same radiations were obtained in each, it was found that one gave practically twice the damping that the other did, the receiving current being practically twice as great in the case of the transmitter having the smaller damping. According to the Austin formula there would have been no difference. He stated that all of the conditions were the same, and yet the decrement had a marked effect in determining the receiving energy. Other tests were described the object of which was to show the results of different wave-lengths obtained from a common arc transmission, under the condition that the power in each case should be constant. In both cases a very marked maximum was found in the radiation curve. At one station the maximum was obtained by a wave-length of 7500 meters, or three times the period of the aerial. In the other station the wave-length was 5700 meters, again three times the natural periodicity of the system.

Paying Employees' Dues in Company Sections

A lengthy discussion took place at a recent meeting of the New England N. E. L. A. Section relative to the wisdom of a company's paying its employees' dues in organizations like the company section of the N. E. L. A. The general opinion was that such a policy should not be maintained over a year by any company with respect to any individual employee, and some speakers favored paying half the dues for the first year and then leaving the matter to the employee. The point was made that unless a privilege costs something it is apt to be unappreciated. Other speakers held that the payment of the initiation fee on the instalment plan has worked out well among lower-salaried workers. The New England Section will accommodate a new member in this way. President Gibbs described the work of company sections.

The delegates to the convention went on to discuss accident prevention. Under this head it was stated that the Boston Edison company has a standing offer of $1 to every employee reporting a possible cause of accident on the system. Mr. Eugene Carpenter, Newton, Mass., said that much can be done in the direction of co-operation with contractors in securing data upon which to base safety work. At Lowell, Mass., the use of employees' identification cards, bearing the employee's photograph and signature and the manager's signature, has replaced the use of metallic badges. At Woonsocket, R. I., the Blackstone Valley Gas & Electric Company issues a valuable "service code" for the benefit of employees, covering the broad principles which should govern him in his relations with the public and the company's customers.

Producing Vector Diagrams Experimentally

Description of Improved Apparatus Designed to Visualize Alternating-Current Diagrams

BY A. E. KENNELLY AND H. G. CRANE

IN the ELECTRICAL WORLD of March 30, 1911,[1] the authors described a new method of presenting an alternating-current plane-vector diagram visually and experimentally. A rotating electric current is produced in a metallic sheet by means of two equal alternating currents in quadrature, and a contact pin connected with an external impedance is applied by trial to such a point on the sheet as will cause no current to be indicated on a sensitive vibration galvanometer in its circuit. This contact point forms the vertex of a certain vector triangle that may then be observed or marked off on the face of the sheet. In the present article there is described an improvement in the construction and operation of the apparatus. The construction of the original apparatus, as described in the 1911 article, may be here briefly recapitulated.

Construction of the Original Apparatus of 1911

The original apparatus is indicated diagrammatically in Fig. 1. It consisted essentially of a square sheet of zinc mounted on a flat wooden supporting frame, with high-resistivity fringes of supply wires uniformly attached to the four sides from copper bars BB' and bb', so that one alternating current passed through the sheet in the horizontal direction, while an equal current of the same frequency but dephased 90 deg. passed through the sheet in the vertical direction. By this means, assuming that the alternating currents were sinusoidal, a pure rotating field of electric intensity, and of electric current, is produced in the sheet, as indicated by the curved arrow ω. A flexible wire, soldered at O to the center of the sheet, leads to a tuned vibration galvanometer G, through the key K. Another flexible wire $1_1 1_1$ soldered to the sheet at 1, at a distance of 35 cm from the center O, along the horizontal axis, leads to a standard resistor R_o, which is substantially inductanceless. The movable-contact wire $2_1 2_1$ connects with an impedance Z. When no current passes through the galvanometer G, with the contact applied at 2, the right-angled triangle $Oj2$ presents to the eye the vector-impedance diagram, of the impedance Z, and also any of the associated vector diagrams for emf, power or cyclic energy.[2]

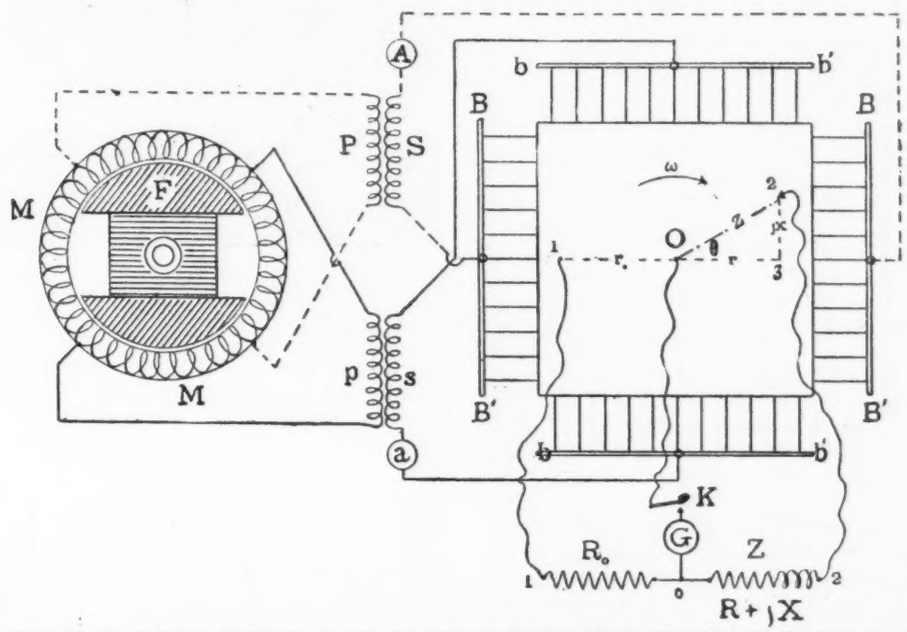


FIG. 1—CONNECTIONS OF VECTOR-DIAGRAM PLATE TO THE QUARTER-PHASE SOURCE AND TO THE MEASURING CIRCUIT

Difficulty Encountered in the Original Apparatus

It was pointed out in the 1911 article that a very appreciable difficulty in the use of the apparatus for quantitative purposes was due to magnetic leakage over the surface of the plate. The rotating electric-current sheet establishes also a rotating magnetic field, whirling with the current. The strength of this field in the vicinity of the plate is ordinarily only a fraction of 1 gauss, but rotating at sixty revolutions per second, as would correspond to a frequency of sixty cycles per second in the quarter-phase supply currents, this field is able to induce a very appreciable emf in the loops of wire leading from the sheet to the apparatus tested. It was, therefore, desirable to keep these connecting wires down flat on the sheet and carry them off in a twisted triple cord from the center, so as to suppress these conducting loops as far as possible. Even with these precautions, however, a slight error due to the stray magnetic field could often be detected, and it was desirable to reverse the stray field—by reversing both of the supply currents—in order to see how far the roaming contact had then to be shifted for zero galvanometer current.

[1] "A New and Direct Process of Producing Alternating-Current Vector Diagrams Experimentally," by A. E. Kennelly, H. G. Crane and J. W. Davis, ELECTRICAL WORLD, Vol. 57, No. 13, pp. 783-787, March 30, 1911.

[2] The theory of the action of this vector-diagram producer was given in a paper on "The Rotating Electric-Current Field," by A. E. Kennelly, published in the *Transactions* of the International Electrical Congress at Turin, 1912, Vol. 2, pp. 1180-1214. See also *Trans.* A. I. E. E., Vol. XXIX, Part 2, June 29, 1910, page 1254.

New Modification of the Apparatus

The above-mentioned magnetic leakage difficulty has been overcome in the new apparatus by providing a duplicate or return-path sheet for each of the two component single-phase currents. This allows each current to flow through the ruled sheet in one direction, and to return through a dummy sheet, underneath, in the opposite direction, so as to effect a mutual cancellation of magnetic effects. The two sheets are separated by a thin layer of varnished cambric. There are two dummy sheets, one for each component current, or three sheets in all, interleaved with two layers of insulating cambric. All three sheets have the same dimensions, but the top sheet, with its ruled surface, is the only one visible. The arrangement is indicated diagrammatically in Fig. 2, where the three sheets are shown separated for easier distinction. It will be observed that the supply leads come to two sides only of the construction, in twisted pairs, so that if the high-resistance fringe wires are held firmly in close loops, all of the circuit elements in the system are so distributed as to cancel out magnetic effects over the surface of the sheet.

In the new construction the sheets, instead of being composed of zinc, are of "Ia-Ia" high-resistivity metal. Each sheet measures 61 cm by 61 cm (24 in. by 24 in.) and is 23 B. & S. gage, 0.56 mm (0.022 in.) thick. The resistivity of the material is approximately 44 microhm-cm; so that the linear resistance of the full width of sheet is 12.9 microhms per linear cm. A current of 1 amp distributed over the full width of the sheet therefore produces a drop of potential of 12.9 microvolts per cm of length, or 787 microvolts across the entire sheet. The resistance of a square centimeter of the sheet, between parallel edges, is also 787 microhms.

The fringe wires are also composed of "Ia-Ia" metal, No. 24 B. & S., of diameter 0.051 cm (0.020 in.). There are nine wires in each side fringe, or thirty-six in all, bordering the ruled sheet. Each wire is 18.0 cm (7.1 in.) long. The linear resistance of each wire is 0.026 ohm per cm, making the resistance of each fringe 0.052 ohm. The fringe wires are all covered by the woodwork of the frame, which, as shown in Fig. 3, leaves the plate alone visible. This plate is ruled into centimeter squares by straight scratches parallel to the X and Y axes of the plate, at uniform distances of 1

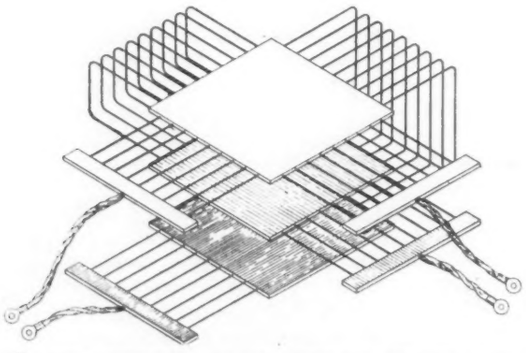


FIG. 2—THE WORKING PLATE, SHOWN ON TOP, AND THE TWO COMPENSATING PLATES

cm. The back of the frame is also covered over with wood, but grated ventilating holes are left to allow air to circulate around and cool the fringe wires.

Operation of the Improved Apparatus

The two single-phase components of alternating current are supplied to the apparatus from their respective transformers through twisted pairs of wires and indicating ammeters. A current of about 12 amp is ordinarily supplied through each circuit. The vibration galvanometer is tuned to the frequency of the circuit. The connecting wires between the plate and the test circuit *RZ* (Fig. 1) do not need to be looped or flattened against the sheet, because there is practically no stray magnetic field surrounding the sheet. The result is that the contact point of the roaming electrode on the

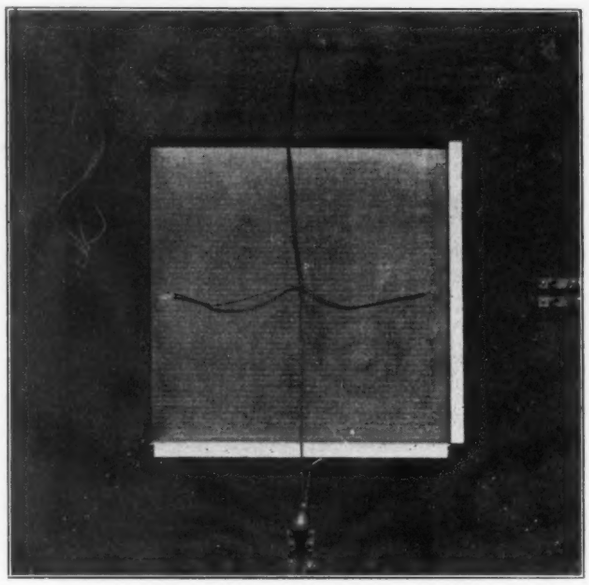


FIG. 3—VECTOR-DIAGRAM PLATE IN WOODEN FRAME

sheet, for zero current in the vibration galvanometer, can be determined with convenience and precision. Reversing the direction of the stray field has ordinarily very little influence on the galvanometer zero.

Although the apparatus may be used for the measurement of impedances, and especially of small impedances, yet its principal use is to give concrete visual representation of vector diagrams to the student of alternating currents. A student who has once used the apparatus for presenting a vector diagram experimentally and visually carries away a more definite idea of such a diagram than is likely to be obtained from a mere examination of the pages in a book on the subject.

The authors are indebted to Mr. F. D. Everett for working out the triple-sheet combination of return circuits, and to Mr. F. W. Lieberknecht for help in the design and construction of the new device.

The new apparatus here described is so easily constructed and gives such satisfactory experimental results that we have found it advisable to maintain the apparatus in regular laboratory service for the use of students in the study of alternating currents.

Cloth-Covered Casings for Motors in Dusty Places

In flour mills, stone mills and other plants where it is necessary to protect motors against dust objection has been found to the solid wooden housings or coverings with which the motors are sometimes provided. As these inclosing structures must be built to be tight enough to prevent the entrance of dust, they also interfere with the egress of heat and may cause overheating in motors designed for free ventilation in the open air. A practical protective casing can be made, however, by erecting a framework about the motor and covering this over with cheesecloth or other fabric. The open weave of the cloth permits the ready escape of heat but prevents the entrance of dust to the motor.

FACTORS IN RATE-MAKING—III*

Considerations Which Govern Rates and Some New Forms of Utility Schedules

BY ARTHUR S. IVES

In discussing costs and determining factors for schedules we have endeavored thus far to prorate every item of cost to each class of service affected thereby. The total cost of each item, therefore, is averaged over all kilowatt-hours used by all classes of consumers affected.

This is entirely proper and will give satisfactory results for established classes, such as commercial lighting, residence lighting and commercial motor service; such classes bear a relation which will be satisfied by such a condition. In other words, if the lighting rate is satisfactory, the motor-service rate will be, for these classes of service are not only well developed but, generally speaking, are non-competitive. The average light or motor-service consumer could not possibly provide himself with electrical energy at the equivalent of central-station rates, and, to most householders, if the case is properly presented, the advantages of electric lighting over gas or oil will more than offset any increase in cost.

On the other hand, there are other classes of service in which little or no business can be secured at rates carrying their full average share of all fixed and general costs outlined—those in which central-station service competes with other service obtainable at a lower price. Examples are "electric cooking," in competition with the gas or coal range, and "wholesale motor service," in competition with the isolated plant.

Average Versus Increment Costs

It is useless to establish rates too high to secure the business for which they are designed, and this brings us to the general conclusion that the prorated cost of service is not the only thing to be considered. Rates must be based on cost, but must also be low enough to induce consumers to use central-station service rather than any substitute.

Sometimes this can be accomplished by considering only increment costs of service rather than total average prorated costs. "Increment" costs mean the additional cost over what the total cost would be if the other services only were taken into account.

Where some particular class of business cannot be obtained with rates based on average prorated costs, we should try rates based on increment costs of such service, and this cannot be considered discriminatory because the other consumers are not only no worse off than if this new business were not secured, but the increased output will help to decrease unit generating costs, benefiting all consumers.

We may also consider that the central station's function is primarily to provide for the consumer who cannot serve himself. Therefore, such consumers (namely, average lighting and small motor-service users) should properly bear all organization charges and general expenses. They benefit by increase in total output or load-factor, and therefore by commercial development along new lines. It is generally necessary to offer "inducements" to encourage new developments, and this we can do by basing rates for such service on increment costs. Such a basis should, however, be considered a positive minimum, for lower rates would be below cost.

Subsequent new commercial business lines developed by rates based on increment costs can be made to bear their share of general expense as increased volume and improved load-factor make for lower average cost. Generally speaking, such a result would not be reached in any other way.

Alternate Rates

In spite of the advantages to consumers of a load-factor rate and of the simplified form outlined, there will always be some consumers who will prefer a straight metered rate, and it will be to the company's advantage to have an alternate rate.

This rate will be useful not only for such conditions but also for temporary service which would not warrant a yearly contract, as well as for the very short-hour consumer whose rate otherwise would be prohibitive.

In fixing this rate, we may use the formula already deduced for our primary rate per kilowatt-hour, namely,

$$\frac{F \times I}{N} + V$$

but substituting a smaller value of N, which stands for the average hours' use per day of consumer's maximum demand.

The resulting rate will be higher than the primary rate, as it should be, unless the selection of a proper value for N should have to be modified to keep within the maximum set by expediency or by regulation. In such case the corresponding value of N can be ascertained by reversing the formula, and no effort should be made to secure business having an hours' use of demand less than such value. No discounts other than a prompt-payment or cash discount should be allowed in connection with this rate.

Contracts

It will have been noted that the above analyses of costs and rate factors are based on annual operating figures, and therefore it is proper to ask consumers who benefit by such a rate to agree to annual contracts. Those who object can take the open rate, which is on a month-to-month basis, but this will give higher costs to all but very small short-hour consumers.

The form of contract should be as simple as possible and still protect against attempt at fraud or dishonesty. Some companies use a very simple card application which specifies size of connected load, rate, method of measurement, terms of payment and period of contract. This is signed by the applicant, and when approved by the company constitutes a contract. All other conditions are embodied in rules and regulations printed separately, to which the card merely refers. Other companies prefer to include all necessary provisions to make the contract complete in itself. A contract form of the latter class, which is suitable for the form of rate described in these articles, is given on the next page.

One unique feature is the clause relating to the contract term specified as "from the date thereof to the twenty-fifth day of the following November, and self-renewing for successive periods of one year thereafter, unless notice to the contrary is given by either party thirty days before the expiration of the first or any succeeding period." The contract, being self-renewing or continuing, requires no further work by the commercial department to effect renewal except in the rare case of notice by the consumer, and after the initial period, the first month of each succeeding period (December) will generally show the maximum demand for the year, which determines the minimum monthly guarantee for that year.

This applies to lighting service only, as the maximum demand on motor-service contracts is not seasonal in the same way. The initial periods of motor-

*Part I in the series of three articles by Mr. Ives was published in the issue of March 31, 1915, page 655; part II was published on March 27, 1915, page 783.

service contracts may therefore be for one or more full years from date, but should also be made self-renewing for successive yearly periods in the same manner as for lighting contracts. Where a large investment must be made in pole lines, transformers or other equipment, the initial contract period should be proportional to the amount of such investment.

Street-Lighting Rates

The difference between private individual service and municipal street-lighting service is primarily that heretofore in practically all cases of street lighting the company has furnished and installed at its expense all necessary equipment, including lamps, while a private consumer furnishes his lamps and accessories. In other words, the fixed capital investment for street lighting includes not only its proportion of main generating station equipment and distributing system but also all special station equipment devoted exclusively to its use, together with lamps and fixtures and their accessories.

This by itself would prove the necessity of charging more for street-lighting service than the corresponding private-consumer rate based only on connected load or maximum demand and hours' use. But the company has also the burden that the street-lighting rate of obsolescence or depreciation, due to development in the art, has been about three times as great as in any other class of central-station apparatus or equipment.

This means that under present conditions the fixed charge F will be increased by interest, obsolescence, insurance and taxes on the special investment for street lighting only, and that the obsolescence rate must be such as will retire the investment in not more than five to six years, which is about the longest time a street-lighting system has gone without remodeling.

This is partly a question of politics. The council street-lighting committee generally changes its personnel in about that time, and the new committee is anxious to make a showing, especially where no city investment is required. Familiar examples are the successive changes from the open arc to the inclosed type, then the magnetite arc, ornamental incandescent as well as arc lighting, individual and cluster, tungsten incandescent lamps, and now the nitrogen-filled tungsten, all within twelve to fifteen years.

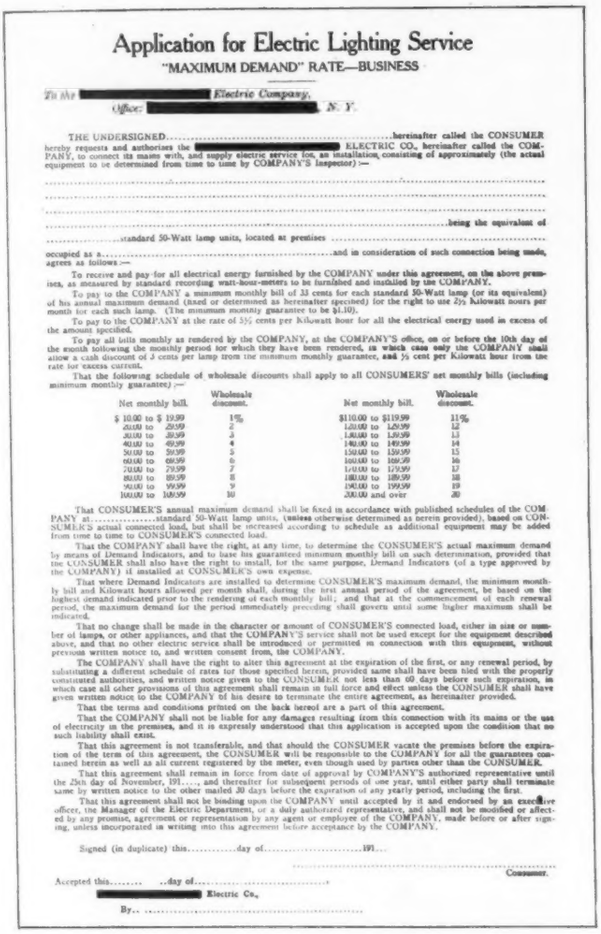
In municipal plants such changes in system have not been so frequent or so radical, presumably because the municipality itself would have to bear such initial cost.

A second reason why street-lighting cost is higher than private-lighting cost is because it is the only consumer in its class and the interweave is 100 per cent; the company must provide a kilowatt of output for every kilowatt of connected load.

A third reason is the cost of special supervision and maintenance required by street-lighting service only.

The almost universal method of charging for street lighting at a fixed annual price per lamp necessitates a specification sufficiently detailed to identify each type and insure that the city will receive the contract equivalent. Some contracts specify lamps by watts consumed and others by candle-power delivered, in many cases without specifying how candle-power should be measured. Such specifications may often cause considerable controversy and even bitterness.

Considering the above conditions, we believe there is a great advantage to both company and city in the method of charging and form of contract developed recently for an Eastern city, which requires the city to own and maintain street lamps, poles and accessories, as well as station equipment used exclusively for street-lighting service, while the company sells elec-



Application for Electric Lighting Service

"MAXIMUM DEMAND" RATE—BUSINESS

To the [redacted] Electric Company,

Office: [redacted], N. Y.

THE UNDERSIGNED.....hereinafter called the CONSUMER hereby requests and authorizes the [redacted] ELECTRIC CO., hereinafter called the COMPANY, to connect its mains with, and supply electric service for, an installation, consisting of approximately (the actual equipment to be determined from time to time by COMPANY'S Inspector):—

.....

.....

.....

.....being the equivalent of

.....standard 50-Watt lamp units, located at premises .....

occupied as a.....and in consideration of such connection being made, agrees as follows:—

To receive and pay for all electrical energy furnished by the COMPANY under this agreement, on the above premises, as measured by standard recording watt-hour-meters to be furnished and installed by the COMPANY.

To pay to the COMPANY a minimum monthly bill of 33 cents for each standard 50-Watt lamp (or its equivalent) of his annual maximum demand (fixed or determined as hereinafter specified) for the right to use 2½ kilowatt hours per month for each such lamp. (The minimum monthly guarantee to be $1.10).

To pay to the COMPANY at the rate of 5½ cents per Kilowatt hour for all the electrical energy used in excess of the amount specified.

To pay all bills monthly as rendered by the COMPANY, at the COMPANY'S office, on or before the 10th day of the month following the monthly period for which they have been rendered, in which case only the COMPANY shall allow a cash discount of 3 cents per lamp from the minimum monthly guarantee, and ½ cent per Kilowatt hour from the rate for excess current.

That the following schedule of wholesale discounts shall apply to all CONSUMERS' net monthly bills (including minimum monthly guarantee):—

Net monthly bill.	Wholesale discount.	Net monthly bill.	Wholesale discount.
$ 10.00 to $ 19.99	1%	$110.00 to $119.99	11%
20.00 to 29.99	2	120.00 to 129.99	12
30.00 to 39.99	3	130.00 to 139.99	13
40.00 to 49.99	4	140.00 to 149.99	14
50.00 to 59.99	5	150.00 to 159.99	15
60.00 to 69.99	6	160.00 to 169.99	16
70.00 to 79.99	7	170.00 to 179.99	17
80.00 to 89.99	8	180.00 to 189.99	18
90.00 to 99.99	9	190.00 to 199.99	19
100.00 to 109.99	10	200.00 and over	20

That CONSUMER'S annual maximum demand shall be fixed in accordance with published schedules of the COMPANY at.....standard 50-Watt lamp units, (unless otherwise determined as herein provided), based on CONSUMER'S actual connected load, but shall be increased according to schedule as additional equipment may be added from time to time to CONSUMER'S connected load.

That the COMPANY shall have the right, at any time, to determine the CONSUMER'S actual maximum demand by means of Demand Indicators, and to base his guaranteed minimum monthly bill on such determination, provided that the CONSUMER shall also have the right to install, for the same purpose, Demand Indicators (of a type approved by the COMPANY) if installed at CONSUMER'S own expense.

That where Demand Indicators are installed to determine CONSUMER'S maximum demand, the minimum monthly bill and Kilowatt hours allowed per month shall, during the first annual period of the agreement, be based on the highest demand indicated prior to the rendering of each monthly bill; and that at the commencement of each renewal period, the maximum demand for the period immediately preceding shall govern until some higher maximum shall be indicated.

That no change shall be made in the character or amount of CONSUMER'S connected load, either in size or number of lamps, or other appliances, and that the COMPANY'S service shall not be used except for the equipment described above, and that no other electric service shall be introduced or permitted in connection with this equipment, without previous written notice to, and written consent from, the COMPANY.

The COMPANY shall have the right to alter this agreement at the expiration of the first, or any renewal period, by substituting a different schedule of rates for those specified herein, provided same shall have been filed with the properly constituted authorities, and written notice given to the CONSUMER not less than 60 days before such expiration, in which case all other provisions of this agreement shall remain in full force and effect unless the CONSUMER shall have given written notice to the COMPANY of his desire to terminate the entire agreement, as hereinafter provided.

That the terms and conditions printed on the back hereof are a part of this agreement.

That the COMPANY shall not be liable for any damages resulting from this connection with its mains or the use of electricity in the premises, and it is expressly understood that this application is accepted upon the condition that no such liability shall exist.

That this agreement is not transferable, and that should the CONSUMER vacate the premises before the expiration of the term of this agreement, the CONSUMER will be responsible to the COMPANY for all the guarantees contained herein as well as all current registered by the meter, even though used by parties other than the CONSUMER.

That this agreement shall remain in force from date of approval by COMPANY'S authorized representative until the 25th day of November, 191...., and thereafter for subsequent periods of one year, until either party shall terminate same by written notice to the other mailed 30 days before the expiration of any yearly period, including the first.

That this agreement shall not be binding upon the COMPANY until accepted by it and endorsed by an executive officer, the Manager of the Electric Department, or a duly authorized representative, and shall not be modified or affected by any promise, agreement or representation by any agent or employee of the COMPANY, made before or after signing, unless incorporated in writing into this agreement before acceptance by the COMPANY.

Signed (in duplicate) this.....day of.....191...

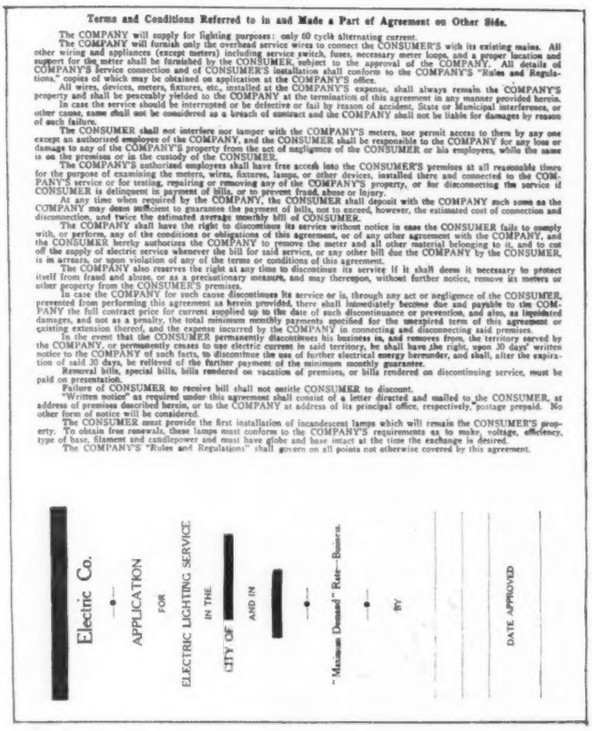
.....
Consumer.

Accepted this.....day of.....

[redacted] Electric Co.,

By.. .....

FIG. 1—FRONT OF CONTRACT FOR ELECTRIC SERVICE ON THE MAXIMUM-DEMAND RATE SCHEDULE



Terms and Conditions Referred to in and Made a Part of Agreement on Other Side.

The COMPANY will supply for lighting purposes: only 60 cycle alternating current.

The COMPANY will furnish only the overhead service wires to connect the CONSUMER'S with its existing mains. All other wiring and appliances (except meters) including service switch, fuses, necessary meter loops, and a proper location and support for the meter shall be furnished by the CONSUMER, subject to the approval of the COMPANY. All details of COMPANY'S service connection and of CONSUMER'S installation shall conform to the COMPANY'S "Rules and Regulations," copies of which may be obtained on application at the COMPANY'S office.

All wires, meters, fixtures, etc., installed at the COMPANY'S expense, shall always remain the COMPANY'S property and shall be peaceably yielded to the COMPANY at the termination of this agreement in any manner provided herein.

In case the service should be interrupted or be defective or fail by reason of accident, State or Municipal interferences, or other cause, same shall not be considered as a breach of contract and the COMPANY shall not be liable for damages by reason of such failure.

The CONSUMER shall not interfere nor tamper with the COMPANY'S meters, nor permit access to them by any one except an authorized employee of the COMPANY, and the CONSUMER shall be responsible to the COMPANY for any loss or damage to any of the COMPANY'S property from the act of negligence of the CONSUMER or his employees, while the same is on the premises or in the custody of the CONSUMER.

The COMPANY'S authorized employees shall have free access into the CONSUMER'S premises at all reasonable times for the purpose of examining the meters, wires, fixtures, lamps, or other devices, installed there and connected to the COMPANY'S service for testing, repairing or removing any of the COMPANY'S property, or for disconnecting the service if CONSUMER is delinquent in payment of bills, or to prevent fraud, abuse or injury.

At any time when required by the COMPANY, the CONSUMER shall deposit with the COMPANY such sums as the COMPANY may deem sufficient to guarantee the payment of bills, not to exceed, however, the estimated cost of connection and disconnection, and twice the estimated average monthly bill of CONSUMER.

The COMPANY shall have the right to discontinue its service without notice in case the CONSUMER fails to comply with, or perform, any of the conditions or obligations of this agreement, or of any other agreement with the COMPANY, and the CONSUMER hereby authorizes the COMPANY to remove the meter and all other material belonging to it, and to cut off the supply of electric service whenever the bill for said service, or any other bill due the COMPANY by the CONSUMER, is in arrears, or upon violation of any of the terms or conditions of this agreement.

The COMPANY also reserves the right at any time to discontinue its service if it shall deem it necessary to protect itself from fraud and abuse, or as a precautionary measure, and may therefrom, without further notice, remove its meters or other property from the CONSUMER'S premises.

In case the COMPANY for such cause discontinues its service or is, through any act or negligence of the CONSUMER, prevented from performing this agreement as herein provided, there shall immediately become due and payable to the COMPANY the full amount of the contract price for current supplied up to the date of such discontinuance or prevention, and also, as liquidated damages, and not as a penalty, the total minimum monthly payments specified for the unexpired term of this agreement or existing extension thereof, and the expense incurred by the COMPANY in connecting and disconnecting said premises.

In the event that the CONSUMER permanently discontinues his business in, and removes from, the territory served by the COMPANY, or permanently ceases to use electric current in said territory, he shall have the right, upon 30 days' written notice to the COMPANY of such intent, to discontinue the use of further electrical energy hereunder, and shall, after the expiration of said 30 days, be relieved of the further payment of the minimum monthly guarantee.

Removal bills, special bills, bills rendered on vacation of premises, or bills rendered on discontinuing service, must be paid on presentation.

Failure of CONSUMER to receive bill shall not entitle CONSUMER to discount.

"Written notice" as required under this agreement shall consist of a letter directed and mailed to the CONSUMER, at address of premises described herein, or to the COMPANY at address of its principal office, respectively, postage prepaid. No other form of notice will be considered.

The CONSUMER must provide the first installation of incandescent lamps which will remain the CONSUMER'S property. To obtain free renewals, these lamps must conform to the COMPANY'S requirements as to make, voltage, efficiency, type of base, filament and candlepower and must have globe and base intact at the time the exchange is desired.

The COMPANY'S "Rules and Regulations" shall govern on all points not otherwise covered by this agreement.

[redacted] Electric Co.

APPLICATION FOR ELECTRIC LIGHTING SERVICE IN THE CITY OF [redacted] AND IN [redacted]

"Maximum Demand" Rate—Business.

BY

DATE APPROVED

FIG. 2—BACK OF CONTRACT, SHOWING THE TERMS AND CONDITIONS

tric energy to the city the same as to any other consumer and at a specified kilowatt-hour rate. The city can spend for changes in lights without changing rate or contract, and argument as to lamp specifications is eliminated. The company has no special investment for street lighting, and the general "interweave" applies to fixed charges on general station equipment the same as in the case of other lighting consumers.

For series lighting systems energy should be sold at the generating station between the station bus and series transformers or rectifiers and metered directly. For multiple systems, where lamps are supplied from regular commercial circuits, kilowatt-hours can be calculated closely from the rating of each lamp and hours of burning as determined by time switches or otherwise.

Using the same formula as for commercial rates and having regard for the factors in each case, the proper rate can be calculated.

Gas Rates

It is rather remarkable that in spite of widespread interest in electric rate analysis so little has been done in developing logical gas rates. Nearly all gas rates are of the character of twenty-five years ago, namely, "straight" metered rates per 1000 cu. ft. with a uniform cash discount for prompt payment, or occasionally a graded discount which produces the equivalent of a "stepped" metered rate.

Recently it has been suggested that a gas load-factor rate could be adopted, and the suggestion has aroused considerable interest.

The "storage" argument does not apply, but in the gas business, as in the electric, the total investment required is several times the gross annual revenue; it takes three, four, five or sometimes more years for a gas company to turn over its capital, instead of three or four months, as in the case of, for example, department stores.

Since investment or fixed charges are so large a proportion of total costs, it is proper that gas as well as electric companies should prorate such charges according to the consumer's demand. This can be accomplished by the rate system described for electric service, and the analysis would be along corresponding lines.

Such a rate would enable gas companies to secure long-hour industrial business in competition with low-grade oils, which cannot be touched under the present system. In developing new uses for gas, rates based on increment cost may be justified.

For small consumers and for temporary service an alternate straight metered rate will be necessary. Rates may be developed similarly to the electric rates described.

Fractional Rates for Small Gas Consumers

There is one further detail which does not apply to the electric rate system but may be considered for gas rates. The commercial unit, 1000 cu. ft., is comparatively large, and there are many consumers whose monthly use is 100 cu. ft. or 200 cu. ft., giving, at $1 per 1000 cu. ft., a bill of 10 cents or 20 cents.

Owing to long-established use of illuminating gas and the high efficiency of mantle lights of the Welsbach type, there are large numbers of such "fractional" consumers, and the "dollar minimum" usually applied for electric service would be a hardship and tend to reduce gas consumption.

A compromise sliding-scale rate is suggested for fractional consumption (less than 1000 cu. ft. per month) which will have many possible advantages, of which the following (for a base rate of $1) would be an example:

SLIDING-RATE SCALE FOR SMALL GAS CONSUMERS

Cubic Feet	Total Charge	Cubic Feet	Total Charge
100	$0.25	600	$0.78
200	0.40	700	0.85
300	0.51	800	0.91
400	0.61	900	0.96
500	0.70	1000	1.00

Where the base rate is more or less than $1 the sliding scale would be proportional. Such a method shows the small consumer at once the advantage of becoming a larger consumer, as each successive 100 cu. ft. costs less and lowers his average rate. This gradually educates him to a better understanding of the principle of load-factor rates. The company benefits by a return more nearly proportional to cost of service.

Summary

(1) The strongest argument in favor of a "load-factor" rate is that it is identical in character with isolated-plant cost.

(2) Rates must be based on practical comparison between cost for each individual and general average cost, preferably on a classification of consumers.

(3) Classification suggested:

(A) Geographical districts: (a) zonal; (b) with special construction; (c) different densities of population.

(B) By interweave, depending on character of service.

(C) By time of consumer's demand; peak or off-peak.

(D) By size of load, wholesale or retail.

(4) The true reason why commercial motor-service rates should be lower than commercial-light rates is that, on account of a better "interweave" of demand, less generating equipment takes care of an equal aggregate of consumers' demand.

(5) While the "three-rate" system approaches nearest to actual cost conditions, it is the most complicated to present to consumers.

(6) It may be simplified by substituting for "consumer charge" a properly graduated wholesale discount in connection with a minimum monthly guarantee in a "two-rate" system without losing any of its advantages.

(7) Determination of certain "rate factors" from data on investment and operating cost should be the first step in rate analysis; these can be used in devising any form of load-factor rates.

(8) Rates based on increment costs should be substituted for standard rates whenever by so doing new and desirable classes of business can be developed.

(9) Load-factor rates should be on annual contract basis. As an alternative open metered rates may be available for short-term or very small consumers.

(10) Contracts should be self-renewing at end of initial term.

(11) Street-lighting service should be based preferably on municipal ownership of posts, lamps, appurtenances and station or other equipment specially required by such service, and only the sale of energy by the company.

(12) Gas rates should be of the load-factor type and may be justified by the high ratio of investment to income.

(13) Fractional gas rates will help to solve the very-small-consumer problem.

DIGEST OF ELECTRICAL LITERATURE

Generators, Motors and Transformers

Standardization Rules.—E. SCHUFLER.—The first part of an article in which the author discusses in detail the new standardization rules of the American Institute of Electrical Engineers. It is emphasized that these rules are the "results of extraordinarily careful consultations" and contain "numerous new and interesting views." In the present instalment the only thing to which a serious objection is raised is the method for determining the temperature in the field coils by means of embedded thermocouples. "The introduction of this method of measurement, not for single laboratory experiments, but for general tests—which are usually made at the place where the machines are to be used—seems to us to be of rather doubtful usefulness. Imagine that all turbo-generators and most high-tension machines for larger capacities must be provided with a larger number of thermocouples embedded in the slots together with the conductors leading to the thermocouples. It seems very doubtful whether the advantage thereby obtained would compensate in any way for the loss of reliability in service." The article is to be concluded.—*Elek. Zeit.*, March 11, 1915.

Direct-Current Machines.—B. G. LAMME.—In the serial on the engineering evolution of electrical apparatus the article on the development of the direct-current generator in America is being continued. The author deals especially with brushes and brush-holders, brush-holder supports, commutators, temperature and ventilation.—*Elec. Journal*, April, 1915.

High-Speed Commutator Construction.—C. C. HAWKINS.—An important point in the construction of shrink-ring commutators for high speeds is the maintenance of sufficient side compression on the mica insulation between the copper sectors. In the present paper a formula for determining this quantitatively at full speed is suggested as a working solution sufficiently accurate for the purposes of design.—London *Electrician*, March 26, 1915.

Temperature Rise in Field Coils.—MAGNUS MACLEAN, D. J. MACKELLAR AND R. S. BEGG.—In ordering recently a continuous-current motor for the Royal Technical College, Glasgow, the makers were asked to insert in one of the field coils five thermocouples as shown in Fig. 1. The object was to determine the temperature

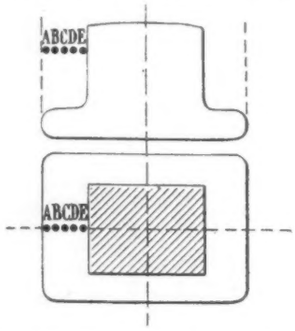


FIG. 1—SECTION OF CONTINUOUS-CURRENT MOTOR WITH FIVE THERMOCOUPLES IN FIELD COIL

rise at various points in a field coil of a 120-kw variable-speed continuous-current motor, under various conditions of load, at various speeds, and with various field currents, and to deduce a heating coefficient for use in designing the field coils for a machine of this type. The thermocouples were inserted as follows: *A* at a point just under the outer layer, *B*, *C*, *D* at points one-fourth, one-half and three-fourths of the distance toward the pole core, and *E* just above the innermost layer. Fig. 2 is a set of curves showing the actual temperature of the couple *A*, the rise of temperature at the couples *A*, *B*, *C*, and the room temperature, all plotted on a time base. These curves are for a field current of 1.2 amp and an armature current of 50 amp. The rise of tem-

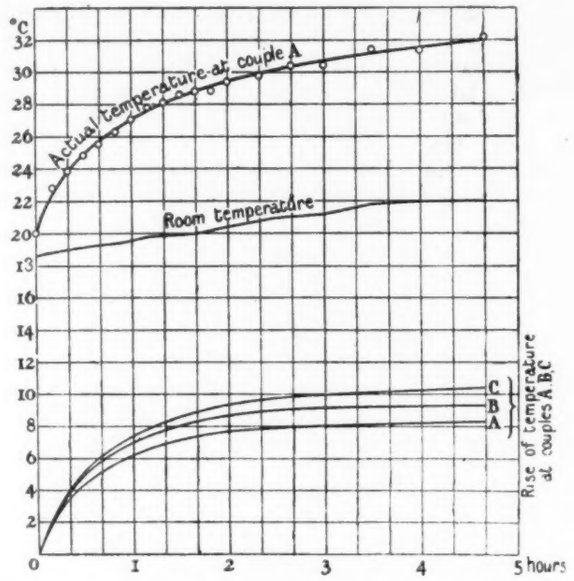


FIG. 2—CURVES SHOWING TEMPERATURE OF THERMOCOUPLES

perature of *E* is so nearly that of *A*, and that of *D* so nearly that of *B*, that they are omitted from the figures.—London *Electrician*, March 26, 1915.

Lamps and Lighting

Rating of Incandescent Lamps.—FRANCIS W. WILLCOX.—A paper read before the (British) Illuminating Engineering Society. The author points out that the rating of incandescent lamps has been changed to total watts in place of candle-power. The adoption of the watt rating has resulted in the establishment of a line of fixed standard watt values, 10, 15, 20, 30, 40, 60, 80, 100, 200, etc., watts for metallic filament lamps, which all manufacturers have adopted. While candle-power values will still be used as needed, they will be derived values obtained by dividing the watt rating by the "efficiency." It is very important to the largest class of lamp users—electric-supply-station customers—to have the total watts of the lamps stated and fixed, as lighting service is purchased on the basis of the watts consumed. Moreover, the watts can be quickly determined, and they change not more than 5 per cent during the life of a lamp, while the candle-power may vary 20 per cent. But some unit should be employed for the luminous value of a lamp, and the author discusses whether this unit should be the candle-power or the lumen. "The same reasons which led to the substitution for candle-power of total watts as the practical size rating of electric lamps will, in my opinion, lead (and are already leading) to the adoption of the lumen in place of candle-power where it is necessary to express the luminous value. The fundamental requirement is a definite unit which shall always mean one definite thing. This the lumen is and the candle-power is not. Many variations of candle-power are in use, the mean horizontal, mean spherical, hemispherical upper and hemispherical lower,

and the candle-power values in different directions, etc. Such complications do not arise with the lumen. In determining or expressing efficiency, for example, the usual term 'watts per candle' raises a query at once as to what variety of candle is meant—whereas 'watts per lumen' or 'lumens per watt' is wholly definite. Then, again, the desirable unit should not permit of manipulation or alteration of value (apparent or otherwise) by reason of change in shape of the luminous body (lamp filament) or through the use of any external or accessory devices, such as reflectors. Now this has been found in experience to be the chief defect of candle-power as a unit. . . . The luminous output of a lamp as expressed in lumens remains the same whatever the shape of the filament and no matter what variations of external arrangements or what accessories (reflectors, etc.) may be employed with it (excepting, of course, the absorption losses in the accessories). . . . The candle-power suffers from the infirmity of being materially different according to the direction at which it is measured. Practically, a unit of candle-power should have the same value whether measured horizontally, vertically or at any angle. Actually it does not, as we readily find out when we consider the spherical surface surrounding the lamp. This is one of the things that will always be more or less mysterious to the layman and that assist in deception and misleading information. Even those who know the subject fully find it very difficult to judge properly between the merits of different light distributions in the various zones." A great deal of the objection to the lumen is due to the fact that it is a new unit that has hardly come into the experience and practice of very many people in Great Britain. This is not, however, a serious objection, as the unit is easily comprehended and can be readily expressed just as the ordinary candle-power is. The value in lumens of ordinary incandescent lamps is practically ten times the mean horizontal candle-power, that is, 16-cp lamps would have a value of 160 lumens.—London *Electrician*, March 26, 1915.

Generation, Transmission and Distribution

Fuel for Diesel Engines.—HANS SCHMIDT.—In view of the difficulties of Austrian central stations in obtaining during the war the oils chiefly used heretofore in the operation of Diesel engines, the author discusses the possibility of using various oils for Diesel engines, especially tar oils and bituminous coal tar, and the changes which would become necessary in the engine design with the use of such fuels.—*Elek. u. Masch.* (Vienna), Feb. 7, 1915.

Installations, Systems and Appliances

Automatic Protective Switchgear.—E. B. WEDMORE.—The first part of an illustrated paper read before the (British) Institution of Electrical Engineers on the classification of protective devices and feeder systems. In the present instalment the author deals with the protection of independent feeders, selective action with leakage protective apparatus, use of fixed time-limit relays, the earth connection, leakage protection for sources of supply, protection of parallel feeders, and the protection of interconnectors and ring mains.—*The Engineer* (London), March 5, 1915.

Voltage Regulation.—G. E. GRAU.—The author discusses the principle and describes the construction of the high-speed voltage regulator of the Siemens-Schuckert company, outlines its applicability for power and speed regulation, and finally describes a new arrangement in which for the purpose of greater speed of regulation the voltage relay is provided with a peculiar reverse attachment by means of which a premature interruption of the regulation process occurs.—*Elek. Zeit.*, Feb. 11, 1915.

Wires, Wiring and Conduits

Feeder Protective System.—An illustrated description of the Callender-Waters feeder protective system. The cable used for the Callender-Waters protective system is constructed in the ordinary manner, except that, under the lead sheath and lightly insulated from it, there

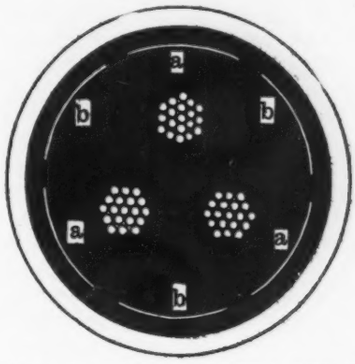


FIG. 3—SECTION OF CABLE SHOWING ARRANGEMENT OF TAPES

are a set of six copper tapes, 0.016 in. thick, put on with a fairly long lay and not touching one another. The insulation between the adjacent tapes is sufficient to withstand 1000 volts. Fig. 3 indicates the arrangement of the tapes in a cable. In the simplest application of the system, alternate tapes *a a a* are connected together and through a relay of earth at one end of the cable, and the tapes *b b b* are connected together and to earth at

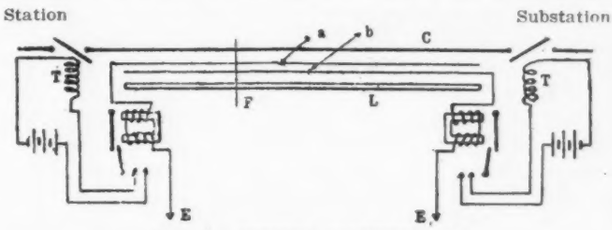



FIG. 4—WIRING CONNECTIONS

the other end. The relay closes the circuit of the tripping coil of the main switch. This is shown diagrammatically in Fig. 4; for simplicity only one main conductor *C* is indicated, and the two sets of tapes and the lead *L* are shown as straight lines. *T* is the tripping coil of the main switch. If an earth fault appears on the conductor through any cause, say at *F*, contact will be made between the conductor *C*, both tapes, and earth. A circuit will then be made from the conductor *C* through the tape *a* and the relay to earth. This in itself

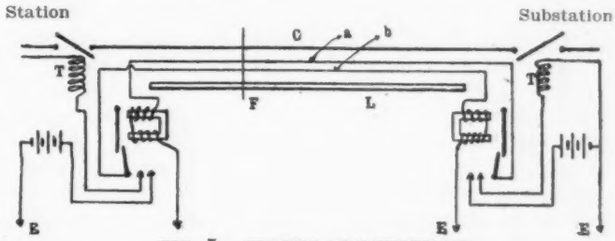


FIG. 5—WIRING CONNECTIONS

might not be sufficient to actuate the relay, as the circuit is obviously shunted by the direct earth connection to the conductor *C* at the fault; but owing to the tape running parallel to the conductor, a strong current induced in it will flow through the circuit, tape *a*, relay, earth, and back to tape *a* at the fault, and this is found to be quite sufficient to work the relay. To provide for the contingency of the fault occurring quite near the

end of the cable, in which case there would only be a short length for this inductive action to take effect, or if only a comparatively small earth current is allowable before the cable is cut off, some iron is threaded over the part of the cable connecting the metal sheathing to the earth plate or outgoing metal sheathing. This has the effect of increasing the impedance of the sheathing, thus forcing the current through the relay to earth. The relay at the substation end should also be actuated by the current made through the tape *b*, and the cable would thus be disconnected automatically at both ends. There is, however, just a possibility that a fault, say from a blow with a pick, might only connect one tape to earth and not two adjacent ones, in which case the cable would still be left disconnected at one end. To meet this contingency the connections are modified in practice to those shown in Fig. 5, which is the arrangement adopted at Northampton and by the London & South Western Railway. On tracing these out, it is seen that as soon as either of the relays operates it closes the circuit of the tripping coil of the local switch and establishes a circuit from the battery, through the unaffected tape and the relay at the other end, and back to the battery through earth. An additional advantage of this arrangement is that there is an electric interlock between the two relays, and the substation switch cannot be replaced until the station relay is restored. A further modification is also described.—London *Elec. Eng'ing*, March 25, 1915.

Units, Measurements and Instruments

Roentgen Ray Tube.—A note on a paper by Sidney Russ on the Coolidge Roentgen ray tube read before the Roentgen Society in London. The tests made by Russ were directed toward the character of the radiation for different spark-gaps and for several values of the heating current, and also the yield of X-rays under various conditions. The measurements were made by means of a small gold-leaf electroscope with walls of lead 4 mm in thickness, fitted with a thin aluminum window, through which the rays from a bulb about 150 cm distant were allowed to enter. The character of the radiation was found by measuring its gradual absorption through increasing thickness of aluminum. Russ found that the radiation of the Coolidge tube was heterogeneous in character, and that if the spark-gap were kept constant the character of the radiation varied, but not greatly, with the heating current. A comparative estimate of the yield of X-rays emitted by the tube under various conditions was made by measuring the ionization produced in the electroscope. In this case the two features to be noted were, first, a large increase in the yield of X-rays produced by a small increase in the heating current, and, second, a relatively larger yield of rays of high penetration than of rays of low penetration when the heating current was increased. The steepness of the yield curves indicated the necessity of having a very open-scale ammeter and a rheostat of fine adjustment, so that the heating current might be kept under rigorous control. In the course of the discussion, N. S. Finzi said that, contrary to the usual experience with the ordinary X-ray tube, when attempting to get rays of high penetration, the Coolidge tube worked much better by using very rapid interruptions and a smaller current in the primary. Duddell, referring to another point in the communication, said that Russ had confirmed his findings by means of an intensimeter in which the change in the electrical resistance of selenium when exposed to X-rays was made the basis for the measurement of X-ray energy. He expressed his surprise that anybody had produced selenium which was definite in its action. He said that he had spent a considerable time upon the attempt, nearly poisoning himself in the process, but that the selenium always varied. He found that ordinary selenium does not remain constant for any length of time. It varies in its electrical resistance from year to year.—London *Electrician*, March 19, 1915.

Telegraphy, Telephony and Signals

Telephone Troubles in the Tropics.—W. Llewellyn Preece.—The author deals in turn with telephone instruments, exchange switchboards and the line, with special reference to troubles that arise from insect life, vegetation, humidity and high temperatures in the tropics, and gives an illustrated description of the connections of an automatic clearing signal which became necessary because subscribers in the tropics simply would not "ring off" after a conversation was finished. —London *Electrician*, March 26, 1915.

Book Review

The Preservation of Structural Timber. By Howard F. Weiss. New York: McGraw-Hill Book Company, Inc. 312 pages, illus. Price, $3.

A book which treats in a thorough and practical manner of methods and processes which tend to prolong the life of wood poles and structural timber generally must necessarily be of interest to the electrical engineer. The author is an expert in matters pertaining to wood preservation, and the scientific accuracy of his statements cannot be questioned; but the chief claim which this book has on the attention of the engineer lies in its eminently practical value. Not only are the various preservative treatments clearly described, but the relative cost and durability of the treated and untreated timber are given wherever possible. In fact, the book seems to have been written with the one central idea always in mind, namely, that the reader may be assisted in deciding what is and what is not the right course to pursue when faced with the problem of selecting the proper kind of timber and of estimating whether or not it will pay to subject it to any of the available processes by which its life may be prolonged. The portion of the book of special interest to the electrical engineer is Chapter IX, dealing with the preservation of poles and cross-arms; but the book as a whole is of great interest to any one studying the scientific and economic aspects of wood preservation. This subject deserves more attention than it has received in the past, and it can be studied to advantage by consulting this book.

Books Received

Drake's Telephone Handbook. By David Penn Moreton. Chicago: Frederick J. Drake & Company. 286 pages, 159 illus. Price, $1.

Annuaire pour l'An 1915. Published by the Bureau of Longitudes. Paris: Gauthier-Villars. 900 pages, illustrated. Price, 1.50 francs.

Proceedings of the American Electric Railway Engineering Association, 1914. Published by the American Electric Railway Association from the office of the secretary, 29 West Thirty-ninth Street, New York. 596 pages, illustrated. Price, $3.50.

Alternating-Current Electricity. First Course. By W. H. Timbie and H. H. Higbie. New York: John Wiley & Sons, Inc. 534 pages, 364 illus. Price, $2.50.

The Mechanics of Electricity. By F. J. B. Cordeiro. New York: Spon & Chamberlain. 78 pages, 7 illus. Price, $1.25.

RECENT TELEPHONE PATENTS

New Circuit Systems

A patent granted to Mr. C. C. Bradbury, of New York City, and assigned to the Stromberg-Carlson Telephone Manufacturing Company, relates to a reverting test for party lines. With one plug of a cord pair inserted in the answering jack of a line and its mate connected to the multiple jack of the same line, a singing tone will be produced in the operator's and calling party's receivers, thereby indicating that a connection has been made with a party on the same line with the caller. The buzz is used to inform the calling party that he must hang up his receiver in order that the party called may be signaled.

A system patented by Mr. A. H. Dyson consists of a step-by-step control relay which causes the calling signal to appear on the operator's board containing the called line. When the operator answers the call the step relay is restored to its normal position and the signal lamp is extinguished. The patent has been assigned to the Western Electric Company.

Messrs. F. R. Parker and E. R. Corwin are the joint inventors of a manual-exchange system in which the plug is provided with an extra contact which registers with a receptacle contact for operating a supervisory lamp. As the plug contact is connected with the line relay, supervision is effected without the use of relays in the cord circuit.

Automatic ringing and listening devices are included in cord-connector circuits of some systems so that the operator may be relieved of manipulating keys. However, when this apparatus is used in calling private branch exchanges the automatic ringing relays must be cut out as soon as the operators respond. To eliminate the disagreeable click which occurs when the relay is tripped out of circuit, Mr. S. B. William has so arranged the listening circuit that the head telephone is not connected to a listening circuit until after the operation of the relay.

This instrument, which has been designed to operate upon direct current only, is connected across the contacts of an alternating-current relay bridged across the line so as to operate throughout the ringing period. Therefore, if the private exchange operator should close her listening key during the ringing period the relay will prevent her receiver being connected until the signal has been completed. The patent on this apparatus has been assigned to the Western Electric Company.

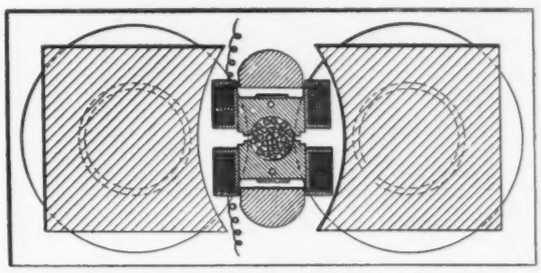
Another invention of interest particularly to private branch exchanges has been patented by Mr. B. G. Jamieson, of Chicago. The apparatus is intended for notifying the private-branch-exchange operator when any particular station is unattended temporarily. The key producing the signal is in a high-resistance circuit, including the line relay, which operates only partially because of reduced current, and therefore does not set the line signal.

Messrs. E. E. Hinrichsen, of Alexander, Ill., and J. F. Toomey, of New York City, are the joint patentees of a through-ringing, through-signaling toll-trunk circuit in which the ringing is under the control of the connecting operator. The operator receiving a request for a connection with a toll point communicates with the toll-switching operator at the distance point over a call circuit and by her is assigned to a toll trunk. The toll-switching operator then proceeds to extend her end of the connection over a second trunk to the desired central office and subscriber. The circuit patented provides means of extending the supervision of the called station to the calling operator and also permits her to control the ringing. When the called party responds the ringing current is interrupted, but it may be re-established by the calling operator by removing and restoring her plug. This patent has also been assigned to the Western Electric Company.

Improved Instruments and New Apparatus

In the repeating device patented by Mr. D. H. Wilson, of New York City, are employed eight repeating coils and four micro-telephone parts. The main circuit passes through two sets of two coils in series. Connecting the junction joints between each of these sets is a circuit consisting of a condenser and the four remaining repeating coils, which are connected in series. The secondary windings of the bridge coils are connected with the receivers of as many micro-telephones, while the respective transmitter circuits are individually connected with the secondary windings of the four line coils. Thus when a message is being transmitted along the line part of the current passes through the bridge coils and induces current in the four receivers. The vibration of the receiver diaphragms will cause the transmitters to amplify the current in their circuits and consequently that in the main line.

The diagram shows a section of a telephone repeater patented by Mr. C. Stille, of Wilmersdorf, Germany. It consists of two oppositely wound coils suspended in a



SECTION OF TELEPHONE REPEATER

strong magnetic field so that they will compress carbon granules in the repeating circuit when current flows through the line wires.

An indicating gang key for selective ringing is the subject of a patent obtained by Mr. A. J. Carter, of Chicago. The key is operated by push-buttons which lock in a half-depressed position to indicate which one was last used. A sliding plate serves as a latch to engage cones on the plungers. When any plunger is depressed the one previously used is released. At the end of the plunger stroke the selective key springs are shifted and the second sliding plate is temporarily displaced, thereby operating a master key on the end of the gang-key frame. The patent has been assigned to the Kellogg Switchboard & Supply Company.

Mr. E. B. Craft has patented a key which is easily assembled and attached to a hard-rubber cupped face plate. The frame parts are formed from sheet metal. The Western Electric Company is the assignee of this patent.

Another patent assigned to the same company refers to a combined jack and signal invented by Mr. A. F. Dixon, of Newark, N. J. Electrical impulses release a suspended colored glass disk which swings in front of the bull's-eye lamp, thereby indicating that a connection is desired. When the answering jack is inserted in its receptacle the disk is restored to its original position.

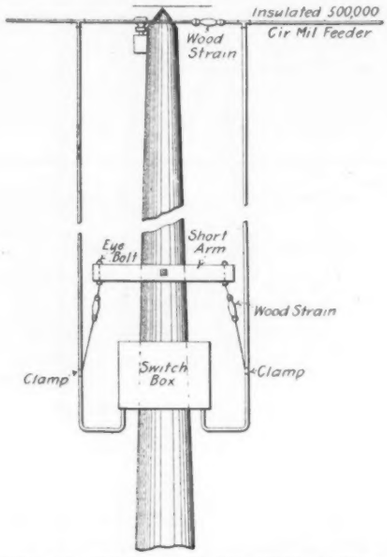
A patent granted to Mr. E. B. Craft and assigned to the Western Electric Company covers details of construction of a polarized bell. The armature is pivoted on trunions attached to the middle of a U-shaped support, which can be flattened to reduce the air-gap between the armature and the cores by turning a screw.

POWER AND OPERATING SECTION

Supporting Sectionalizing Taps on Heavy Feeders

In electric-railway construction heavy feeders operating at from 500 volts to 650 volts are often sectionalized by inserting in the line spring-operated knife switches installed in pole boxes. The taps leading from the overhead feeder to these switches must necessarily be as heavy as the line wire itself, and such taps therefore exert considerable downward pull on the horizontal line, tending to rack the cross-arm, to make the installation appear unsightly, and to bring themselves into contact with the pole.

As a remedy for these troubles an Indiana lighting and railway company has adopted the method of construction shown in the drawing herewith. The auxiliary cross-arm set at right angles to the line cross-arm acts



METHOD OF SUPPORTING SECTIONALIZING TAPS

as a support for insulated hangers, which carry a part of the vertical strain imposed by the weight of the taps, resulting in a neat and workmanlike installation and insuring more permanent construction.

Electrically Operated Coal Plant

What is regarded as a model coal-receiving and distributing equipment is installed at Salem, Mass., in the plant of George W. Pickering. The earlier plant, consisting of wharves, pockets, stable and office building, was entirely wiped out in the conflagration of June 25, 1914, and the present plant has been built and equipped on lines of most approved and economical practice.

The principal coal pocket has a capacity of 3500 tons and is built of hard pine timber on a concrete foundation. The building is divided into five bins, for anthracite coal of various sizes.

An electric conveyor carries the coal, as it is discharged from the vessel into a hopper at the water end of the structure, up an incline to the head of the pocket. The conveyor is of the suspended-flight type, with self-oiling flanged rollers on heavy chain with angle-iron rails. The flights are 24 in. by 10 in. by 24 in., and the traveling parts are carried in a trussed inclosure lined with steel plate. At the head of the incline is a hopper, and coal deposited here is conveyed horizontally at right angles by a second conveyor which runs the length of the pocket, about 100 ft. The inclined conveyor is operated by a 15-hp induction motor on 220-volt, three-phase service from the Salem Electric Lighting Company. The motor, which is rated at 1200/1145 r.p.m., is installed at the upper end of the conveyor and

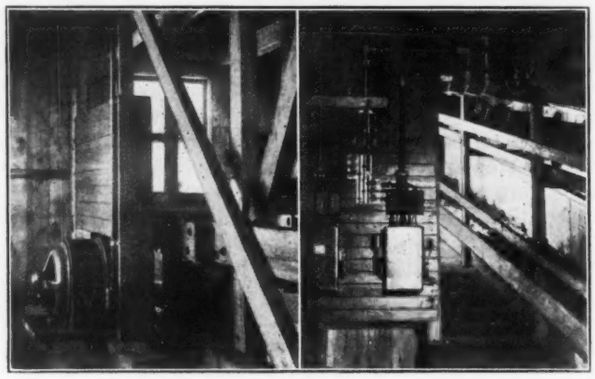


FIG. 1—MOTOR-DRIVEN HOISTING EQUIPMENT

is geared to it through three gears, giving it a speed of 100 ft. per minute.

The horizontal conveyor in the pocket is of similar pattern, but with 8-in. instead of 10-in. flights, these being of malleable iron flanged all around. In the steel-lined trough are five gates at 15-ft. intervals, operated by rack and pinion. Each gate opens into a chute which is so arranged that coal slides rather than falls into its bin, thus saving breakage. At the extremity of the pocket conveyor is a chute for the discharge of soft coal onto field storage. The horizontal conveyor, like the inclined, runs at 100 ft. per minute.

A 10-hp motor is geared to the conveyor, the speed ratio being the same as that of the inclined conveyor. A starting compensator for each motor is installed on the wall of the landing near the hopper into which the

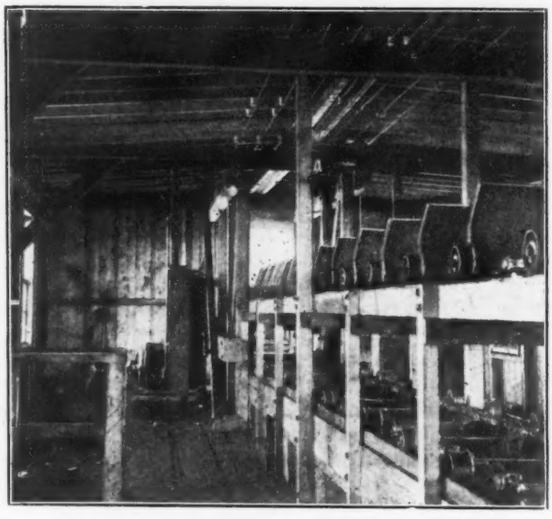


FIG. 2—MOTOR-DRIVEN HORIZONTAL CONVEYOR

buckets are emptied from the barges. A second switch, for the stopping of both motors at once, is situated in the far end of the upper gallery. The conveyors have a capacity of about 160 tons an hour.

A second pocket, for the discharging of soft coal from vessels, is equipped with a Lidgerwood electric

hoist operated by a 22-hp special hoist motor, rated at 680/720 r.p.m., according to load, controlled by a street-car controller which gives a wide range of speed variations. The controller is connected with a hand lever at the hopper, through beveled gears on the controller. The drum by the hoist is controlled from a second hand lever which operates a clutch and a foot lever operating a brake.

The tower is fitted with an inclined boom, supported by an A-frame. Buckets discharge into a hopper, and thence the coal falls into a 1½-ton automatic car which runs out on a trestle railway 200 ft. long. Field storage is here provided for 6000 tons. The present equipment has a rating of about 100 buckets an hour, but it is capable of 50 per cent increase.

In addition to the motors mentioned a 3-hp induction motor is employed in the woodhouse, where it is belted

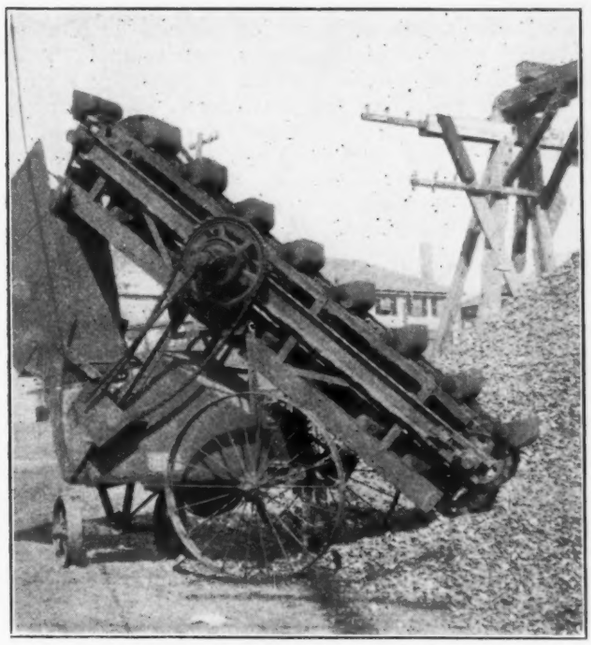


FIG. 3—MOTOR-DRIVEN RE-LOADER

to a 24-in. circular saw. A 5-hp motor is directly connected to a bucket conveyor for elevating coke and charcoal from a pit to the second floor of the bagging shed. A wagon reloader on the ground is equipped with a 7.5-hp motor.

Ground-Testing Device

Before any employee of the United Electric Light & Power Company, New York City, can work on any high-tension equipment he is required to ground apparatus through special cables provided for the purpose. Before the ground cables are attached to the apparatus, however, a ground-testing set is used to remove any static charge, to bring the apparatus to the same potential as the earth, and also to demonstrate that the apparatus is not "alive." The device consists of a cable with one end attached permanently to ground through an expulsion fuse, the other end being fastened to a copper tip on a long stick the handle of which is covered with rubber. If the apparatus is energized when touched with the tip of the stick, the expulsion-type fuse will blow with a loud report, signifying that the apparatus is not safe to work upon.

Before and after discharging the apparatus, the integrity of the circuit to ground is tested by touching the metal tip to a plate which is connected through a lamp to one side of the lighting system. The lighting transformer is grounded at its middle point, so lighting of the lamp indicates that the circuit is all right. These

GROUND-TESTING EQUIPMENT

ground-testing sets are supported on the wall of the station at a number of places convenient to the high-tension apparatus.

Distribution of Power in Electric Generating Stations

BY A. A. POTTER[1] AND W. A. BUCK[2]

Recent reports by the Bureau of Census of the United States Department of Commerce give very interesting figures regarding the distribution of power in electric generating stations.

Fig. 1, based upon the above source, shows the relative importance of direct current and alternating cur-

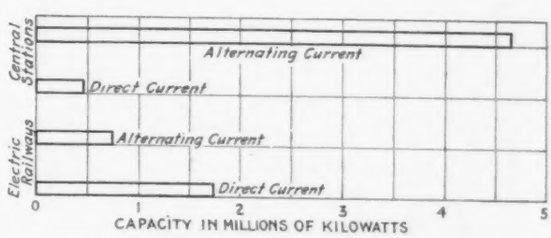


FIG. 1—KILOWATT RATING OF CENTRAL STATIONS AND ELECTRIC RAILWAYS, 1912

rent in central stations as well as in electric railway stations. Of the total kilowatt rating of central stations, 473,690 kw, or 9.2 per cent, is in direct-current generators and 4,661,199 kw, or 90.8 per cent, in alternating-current machines.

[1]Dean of the division of engineering and professor of steam and gas engineering, Kansas State Agricultural College.
[2]Fellow in steam and gas engineering, Kansas State Agricultural College.

The accompanying table and Fig. 2 show the distribution of horse-power in an output of energy from commercial and municipal central electric stations.

The commercial stations generate about 95.3 per

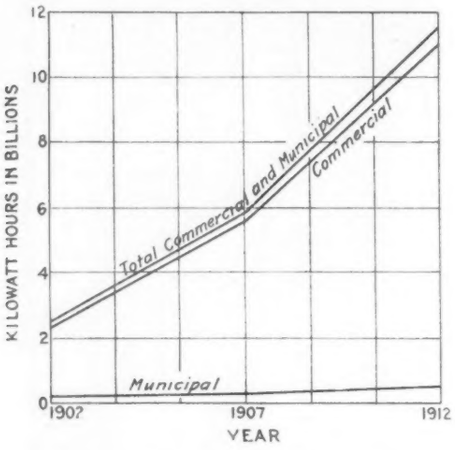


FIG. 2—OUTPUT FROM COMMERCIAL AND MUNICIPAL CENTRAL STATIONS

cent, and the municipal stations only 4.7 per cent of the energy. Considering the 6,052,699,008 kw-hr. generated by power plants for electric railways, the municipal

DISTRIBUTION OF POWER AND ENERGY IN COMMERCIAL AND MUNICIPAL CENTRAL ELECTRIC STATIONS IN 1912
(Source—Department of Commerce, Bureau of Census, Bulletin 124)

	Commercial	Municipal	Total
Total horse-power	6,969,320	559,328	7,528,648
Steam engines—hp	1,585,583	306,493	1,892,076
Steam turbines—hp	2,954,283	100,173	3,054,456
Steam engines and turbines—hp.	4,539,866	406,666	4,946,532
Water motors—hp	2,340,820	130,261	2,471,081
Gas and oil engines—hp	88,634	22,401	111,035
Rating of dynamos—kw	4,766,012	368,677	5,134,689
Kilowatt-hour output	10,995,436,276	537,526,730	11,532,963,006

electric power plants of the United States generate only 3.06 per cent of the total electric energy used in the United States for purposes other than manufacturing.

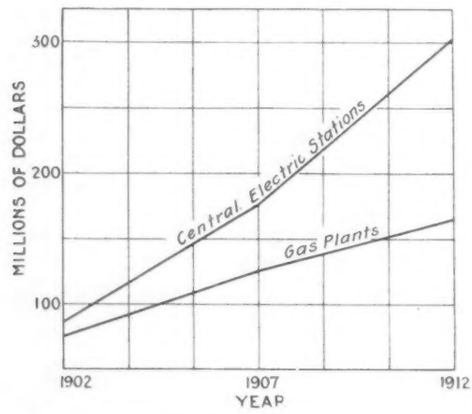


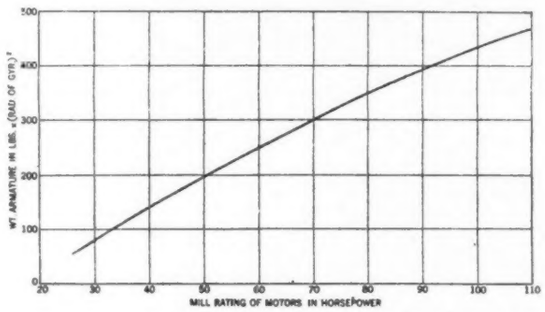
FIG. 3—COMPARATIVE GROSS INCOMES OF CENTRAL STATIONS AND GAS PLANTS

Fig. 3 is interesting for comparing the growths of gas plants and central electric generating stations during the decade from 1902 to 1912.

Motor Drive in the Ore Industry

The general principles underlying the application of electric motors to the ore-handling industry were discussed by Mr. C. D. Gilpin in a paper entitled "Application of Electricity to the Ore-Handling Industry," presented at the recent Cleveland meeting of the A. I. E. E. It was pointed out that if the motor torque required while short-circuiting the resistance is greater than the torque required by the final load the torque obtained when all resistance is cut out will be much larger than necessary. Attention was also called to the fact that the force required to accelerate a trolley may be more than six times the force required to overcome the total friction when the load is moving uniformly. Gantry-crane motors should be capable of propelling a machine against a 10-lb. wind pressure—a load which will usually equal the friction load and may exceed it by 50 per cent.

On long-span cranes it may be desirable to place one or more motors on each truck in order to avoid the expense and friction losses incident to employing a single motor with bevel-gear and shaft drive. Separate controllers are, of course, necessary for each end of the crane, and safety devices should be provided to prevent the crane running askew. With the usual type of trolley used in handling ore the acceleration of the motor armatures may require 10 per cent of the total energy. A curve is published herewith showing the in-



FLYWHEEL EFFECT ON THREE DIFFERENT MAKES OF MILL MOTORS

ertia of armatures of motors rated between 25 hp and 110 hp. The author declared that dynamic braking is practically indispensable for lowering large buckets. In calculating the braking current it should be remembered that the torque produced by the descending load is reduced by losses in the gearing. It was pointed out that the speed of lowering may be allowed to become greater than the hoisting speed if the resistance in the armature circuit is increased and the armature voltage does not rise considerably above its normal value.

In computing the temperature rise of an inclosed motor the author recommends employing the radiating ability of the frame and curves showing the motor loss in watts at various loads. Where several machines are employed which go through similar operating cycles, peak loads may be considerably reduced by operating the machines a portion of a cycle apart. While alternating-current motors may be employed in some parts of an ore-handling plant, they are not always applicable, as they cannot be controlled delicately and economically and because they are larger than direct-current motors of the same rating.

When energy is purchased a demand charge is usually made. If the demand is based on a peak lasting five seconds or less, a flywheel balancer is usually applicable for reducing the demand. The balancer should be provided with regulating apparatus which will allow the flywheel to give up its energy when peak loads come on

and will bring the flywheel up to its former speed after the load has dropped off. In closing, the author discussed the advantage of series-wound, compound and shunt motors.

It was brought out in the discussion of the paper that motor-generator sets with regulating apparatus like that mentioned by the author are as a rule 10 per cent less efficient than rotary-converter sets and that motor-service rates and other terms in central stations' electricity contracts are often the deciding factor in the selection of these two classes of apparatus. In regard to testing motors of an ore-handling installation it was said that the "root-mean-square" method of determining the heating effect should be discarded.

Burning Coal Which Contains Much Slack

If coal containing much slack is fired in large quantities (ranging from 300 lb. to 500 lb.), it may be necessary, according to Technical Paper 80, Bureau of Mines, on "Hand-Firing Soft Coal Under Power-Plant Boilers," to run a slice bar under the fuel bed and pry the large masses of caked fuel slightly upward until they break in pieces. The coal will then burn rapidly and make a very hot fire. A fire rake may be used to break the smaller pieces or to level the fuel bed after the large masses have been broken with the slice bar. This method of firing "slacky" coal appears to work well if the coal contains infusible ash. If coal containing considerable fusible ash is employed, however, it is better to keep the fuel bed about 5 in. thick and prevent the formation of thick crusts by firing small quantities of coal at frequent intervals. Crust which forms will then be thin enough so that it will burn through in a few minutes. The upper surface of the fire may be broken without stirring up the ashes by resting the handle of a rake on the lower edge of the fire door and drawing the prongs lightly over the surface. If too much free ash collects on the grate, a small hook can be run under the fuel bed, care being taken to keep the hook flat against the grate. The hook is of little use if the ashes are fused in large masses to the grate.

Allowance for Holiday Habits

BY H. A. WOODWORTH

On Sundays and other holidays people remain at home and are, as a rule, less active than on other days. When the body is quiet a higher room temperature is needed to insure comfort than at times when muscular activity helps keep the body warm. Reasoning along these lines, the officers of the Merchants' Heat & Light Company at Indianapolis, Ind., have issued the accompanying schedule to the operating engineers who control the temperature of the company's hot-water-heating system.

TEMPERATURE SCHEDULE (IN DEGREES FAHR.) FOR HOT-WATER-HEATING STATION

Outside Temperature	Temperature of Flow	Outside Temperature	Temperature of Flow
− 8	200	30	157
− 5	196	40	145
0	190	50	131
+ 5	184	60	115
+10	178	65	105
20	167	70	95

Note.—On Sundays and holidays maintain a schedule 5 deg. Fahr. higher than the above. Also add one degree for each 2 miles of wind velocity.

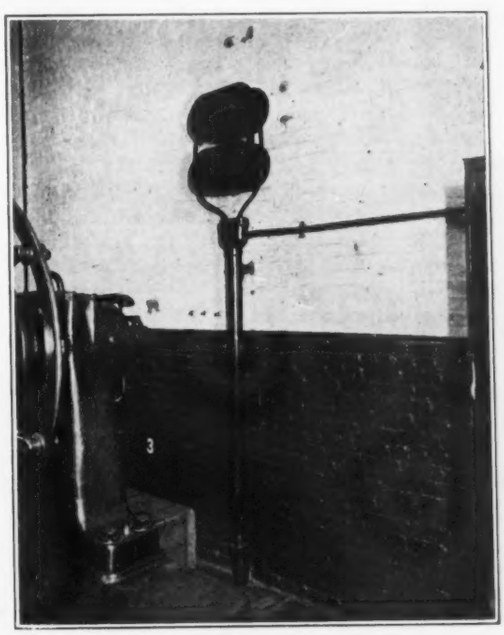
As will be observed, the most interesting part of the schedule is to be found in the footnote. Most of the company's hot-water-heating patrons are residential customers, and the additional 5 deg. given to the outgoing water on holidays brings a large return in good will, while the number of "kicks" registered from the male members of families using this hot-water-heating service is reduced to a minimum.

Marking the "Dead" Wire

Where long transmission-line spans are used to cross rivers or to bridge other obstructions to standard tower spacings a fourth and extra wire is sometimes put up in the long span at the time the original installation is made. This fourth wire helps generally to distribute the strain evenly on the supporting structures, and in event of failure of any of the three live conductors the extra wire can be used to restore service quickly. Looking forward to the time when it may become necessary to use the fourth wire in an emergency, one transmission company in southern Indiana has marked each of its "dead" wires by bolting two pieces of wood together over the wire in midspan. With this marker always visible linemen making a hurried transfer of conductors are less apt to make a mistake.

Loading Coils to Facilitate Synchronizing Rotary Converters

In the Thirty-second Street station of the Edison Electric Illuminating Company of Brooklyn is a rotary converter which is started by a direct-connected induction motor. As an induction motor never attains full synchronous speed, the starter motor had to be provided with one pair fewer poles than the machine it drives, so that supersynchronous speeds could be obtained.



LOADING COIL FOR SYNCHRONIZING ROTARY CONVERTERS

To make this motor slip to synchronous speed, however, open-core loading coils are connected across the alternating-current leads of the rotary converter. These produce a sufficient load on the starter motor to prevent its attaining the speed it would if running light. After the converter is synchronized the loading coils and motor are cut out.

COMMERCIAL SECTION

A CAMPAIGN TO REDUCE DELINQUENCY

A Five-Year Record by the American Gas & Electric Company's Properties

Some interesting figures have recently come to light which cover a five-year campaign among a group of ten public service companies for the purpose of reducing the percentage of delinquent accounts. The data are interesting and useful for several reasons. They embrace cities widely dissimilar in location, size and general character. They extend over a period of time sufficient to justify some definite deductions. They show a gradual, consistent, cumulative benefit on a scale too great to be the product of sporadic influences.

This is an important issue, not alone to the utility company, but to the contractor and the jobber and the

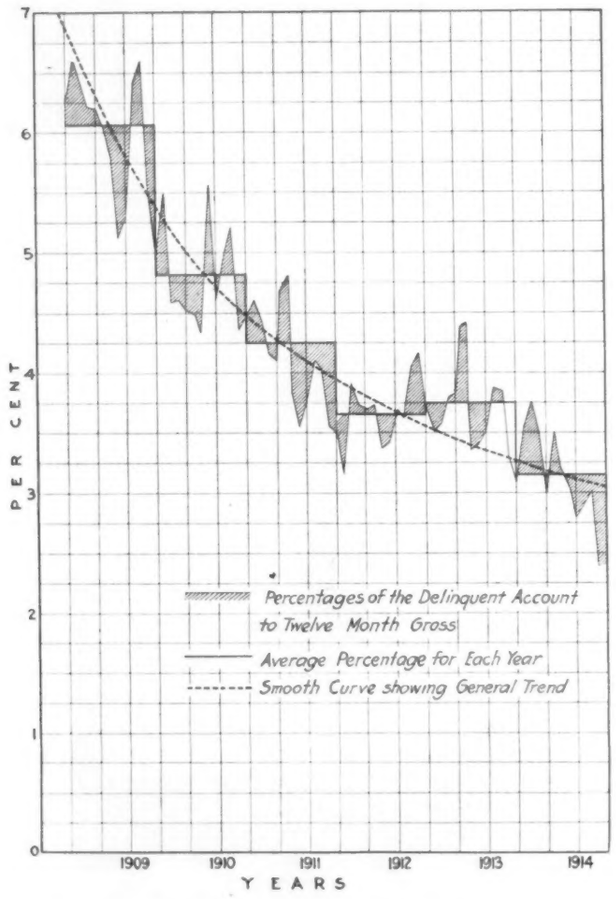


FIG. 1—CURVES SHOWING RATIOS OF DELINQUENT ACCOUNTS TO GROSS EARNINGS

manufacturer and to every other business man. For the money that remains outstanding after the day it is due immediately becomes a source of loss and waste that, dollar for dollar, is no less costly than the robbing of the cash drawer. A hundred dollars lost in interest on delinquent accounts, or a hundred dollars lost through inefficient operation or unskilled purchasing, it is the same. And in a public service enterprise where accounts are small and multitudinous here is a source of waste too often overlooked.

The accompanying curve is plotted from the delinquency reports of the properties of the American Gas & Electric Company, extending from Jan. 1, 1909, to Dec. 31, 1914. Within this period each company was especially urged to use all possible endeavor to reduce the total of its overdue accounts, not by an actual campaign of collection, but by a steady determined tightening up of the collection system. In 1909 these companies had an average of a little over 6 per cent delinquent. This average is now down to 3 per cent. The number of delinquents has been reduced over 17 per cent, in spite of the fact that within these years the gross business has increased 123 per cent. Such is the record presented on the curve here reproduced.

The fine black curve outlines for each month, from January, 1909, to December, 1914, the percentages of the delinquent accounts to the twelve months gross. The shaded portion, therefore, shows at a glance when the delinquent accounts were above or below the average for the year—represented by the heavy black line. The general trend of the delinquent situation is shown by the heavy broken line.

In the March issue of the *A-G-E Bulletin*, the inter-

ROCKFORD ELECTRIC COMPANY
ELECTRIC BUILDING
116 SOUTH WYMAN STREET
ROCKFORD, ILL.

This date our books show a balance due on your account which we believe has escaped your notice, amounting to

If this amount does not agree with your records, kindly advise us and we will see that it is investigated at once.

This, of course, is not a serious oversight, but for the sake of uniformity in handling hundreds of these accounts, an early remittance would be greatly appreciated.

Thanking you in advance for your courtesy in the matter, I am,

Yours very truly,

AG/EM.

Manager.

FIG. 2—REPRODUCTION OF ROCKFORD FIRST LETTER

company house organ of the American Gas & Electric Company, the situation is reviewed editorially with the following comment:

"Since the first table of delinquents was published in the *Bulletin*, managers, collectors and office force have used every endeavor to make their showing the best possible. In most cases, especially where the delinquency was high, a most creditable showing was made, nearly all of the companies decreasing the amount outstanding by 40 or 50 per cent. . . . There is still vast room for improvement. We cannot see the reason why we cannot get the average down to 1 per cent. One of our companies—Barnesville—has not had a delinquent for the last twelve months. Marion and Rockford have never been above 1 per cent. Consumers can be educated to the fact that payments can be met unconditionally at the maturity of the account. Prompt pay-

ment of bills is no more to ask of a consumer than is the efficient service which we supply."

The results obtained by some of the other properties are no less interesting. In Fremont, Ohio, for instance, an average of eight years' experience shows 95.3 per cent of all accounts paid by the tenth of the month, 0.6 per cent by the twelfth, 2.3 per cent by the use of statements, 0.6 per cent by the use of the telephone, 0.3 per cent by the use of cut-off notices, and 0.8 per cent carried over to the following month.

The system under which the collecting of accounts is handled is entirely in the hands of the local manager, but, through the natural suggestion and co-operation among the companies, has become largely standardized throughout the group. The Rockford routine is typical and is described as follows:

"After the tenth of the month all accounts that have not been paid up to that date are put on our monthly collection sheets. If any of these accounts are for house wiring, merchandise, or are outstanding for a longer period than one month, the fact is noted on these sheets. After this we go over these lists and make notations on them by which our stenographer knows what kind of letter to send to these delinquent customers.

"We have several different forms of letters which we send. If a customer has failed to pay his last month's bill by the tenth, the first letter we send draws his attention to the fact that he has overlooked his light bill and informs him that a check to cover this bill would be greatly appreciated. The second month, if he hasn't paid his bill, we ask him direct for a settlement of it. This letter tells him that we don't like to talk of discontinuing his service but we must have some payment on his bill.

THE CANTON ELECTRIC CO
317 CLEVELAND AVE. N. W.

CANTON, OHIO

Folio.....

Dear Sir:

Your account with this Company amounts to $
and is for months' service

Notice was sent you last month requesting payment, which has not met with any response. We again call this to your attention, and non-receipt of a reply enclosing remittance, or a satisfactory reason for failing to pay, will be construed as a desire to have the service disconnected, and service will be disconnected one day after sending out this notice

Yours very respectfully,

THE CANTON ELECTRIC COMPANY,

FIG. 3—REPRODUCTION OF CANTON LAST AND DISCONNECT WARNING

"As a rule, if he is a good customer and is making an honest effort to keep his bills up, he will either send us a check or come in and make some satisfactory arrangement about the payment of his bill. By a study of our customers' methods we can tell when to draw a halt on their credit. When it comes to this point we send a letter giving till a certain date in which to pay this account, and stating that if payment is not made we will disconnect service.

"Every time we send out a disconnect letter we make it a point to see the customer before we disconnect him, and as a rule, if he doesn't pay us, we secure a promise of payment and set a definite date on which to expect it. These promises are followed up closely, and we have to disconnect very few in proportion to the number of letters sent out. The letter is enough for a great many, and when they see that we mean business they are very careful in the future to keep their accounts paid up; but we have what might be called our 'chronic' delinquents, the ones to whom we have to send these disconnect letters about every two months, and again, in some cases, a meter man has to go out to get the meter, and just as he gets the plugs out they are willing to pay."

The manager of one of the other companies writes further details of the system as he has worked it out. He says:

"We created a special credit and collection department, consisting of one credit manager and two collectors, which we kept in operation for about one year. After this we had the matter well enough in hand to dispense with one collector, so that at the present time we have a credit manager and one collector. The duties of the credit manager are to follow up the delinquents as taken from the ledger, send out the first and second notices and supervise the work of the collector, directing him as to the district in which he is to work each day and the accounts which he is to work on.

"When a consumer ignores the first notice and a cut-off notice is sent to him, the account is turned over to the commercial department, forty-eight hours before the cut-off is really effective, so that this department has an opportunity to hold the business if it is possible to do so. As a matter of fact, we do not average over eight cut-offs per month, of which six are immediately reconnected, so that our loss from cut-offs will not exceed two per month. The foregoing is the only use we make of salesmen in collecting, with the exception of one man who collects about thirty-eight accounts per month, he having been a collector before we put him in the sales department and therefore familiar with the characteristics of certain people."

Spirit and Purpose of the Effort

But obviously the most important feature of this campaign to reduce delinquency has not been the details of the collection system, but rather the spirit and purpose of the effort. It was recognized that interest lost on uncollected accounts was little different in the eyes of stockholders from interest unpaid on invested capital. Therefore the prime objective was to eliminate the delinquent as far as possible but without an even more costly loss of customers. So the slogan of the campaign was "courtesy tempered with firmness," and any incivility on the part of a collector was considered a cardinal offense. No attempt was made by any company to put an end to all delinquency at once by the use of arbitrary measures. The change was brought about by gradual influence and encouragement, and this policy has proved its practical effectiveness.

The interesting lesson in the curve, therefore, is this —that the curse of overdue accounts can be well-nigh eliminated, and without recourse to radicalism and the loss of friends. These American Gas & Electric properties had been collecting their bills for years in accordance with prevalent and accepted business methods, with an average of success no worse than would be shown by any other group of companies with analogous conditions. But this matter of collecting overdue accounts had stood as only a detail of the day's work until the limelight fell upon it back in January, 1909.

The actual financial loss involved in slow collecting had never been actively appreciated. Everyone assumed that he was doing as well as could be expected, until more was expected and demanded, with the never-failing reaction. Delinquency was reduced fully 40 to 50 per cent, and the total saving in interest to the companies involved is equal to the earning power of $100,000 at 7 per cent. It is as vital an economy as any that is practised in the most efficient system in the world.

Changes in Rates

Recent changes in rates have been made by various companies as follows:

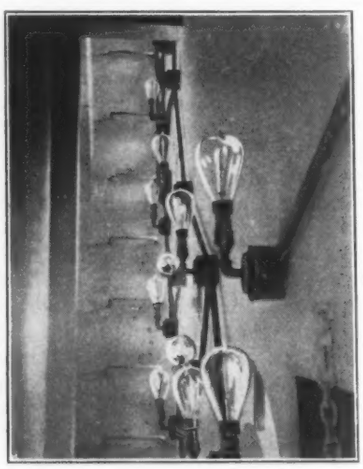
The Worcester (Mass.) Electric Light Company has reduced its maximum rate in Worcester from 10 cents net per kw-hr. to 9 cents, beginning on all bills rendered after March 1. The reduction applies also to the cooking, heating and automobile-charging rate, which was formely 10 cents per kw-hr. net.

The Union Electric Light & Power Company, of St. Louis, Mo., has announced a "modified increment power rate." A minimum monthly charge of $50 is made, for which electrical energy to the extent of 1500 kw-hr. may be used; for additional energy used during each month 2 cents per kw-hr. This rate is applicable to wholesale exclusive electric motor service, and is subject to a discount of 5 per cent on the first $25 and 1 per cent on amounts in excess of $25 on all monthly bills paid within ten days from their date.

The new rates of the Duluth (Minn.) Edison Electric Company, accepted by voters on Jan. 19, are: 1 to 200 kw-hr., 6 cents per kw-hr.; 200 to 500 kw-hr., 5 cents per kw-hr.; all over 500 kw-hr., 4.5 cents per kw-hr.; net motor-service rates on motors 1 hp and less, 4.5 cents per kw-hr., minimum charge 80 cents per month; on motors over 1 hp to 5 hp, 4 cents per kw-hr., minimum charge 80 cents per hp per month; on motors over 5 to 15 hp, 3.2 cents per kw-hr., minimum charge 80 cents per hp per month; on motors over 15 hp, 2.4 cents per kw-hr., minimum charge 80 cents per hp per month. Special rates will be made on special classes of business, according to the load-factor of consumers. An additional charge of 10 per cent will be added if the bill is not paid on or before twelve days from date.

Clock Lighting at Boston Custom House Tower

Indirect lighting is being utilized to advantage in the illumination of the 21-ft. clock dials on the 500-ft. tower of the new Boston Custom House. Each of the four dials is provided with numerals formed by pouring concrete around copper-lined slots from 8 in. to 10 in. wide in the face of the dial, and the numerals are outlined

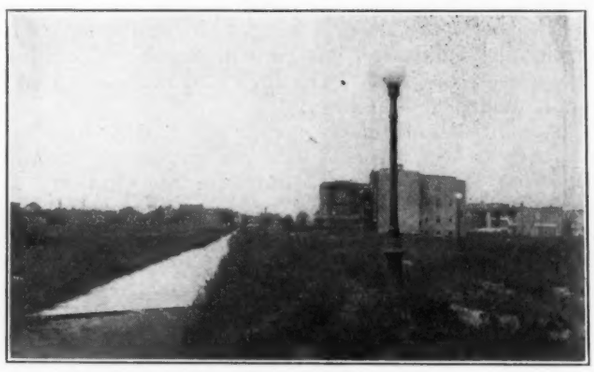


INDIRECT LIGHTING OF CLOCK IN THE BOSTON CUSTOM HOUSE TOWER

by a flood of light from an interior chamber with white walls situated in the tower behind each dial. Seventy 100-watt lamps are mounted in each of the four chambers at angles which screen their direct rays from passing unreflected through the numeral slots, and the lamps are easily reached for cleaning or replacement by short ladders cast in the walls. The numerals are each 3 ft. high. The clock hands are each equipped with twelve 100-watt lamps mounted between the hands and the dial.

Chicago's Suburban Street-Lighting Policy

Generally speaking, ornamental street lighting and similar city improvements follow rather than antedate the building up of outlying residential sections. In



LIGHTING UNINHABITED STREETS AT 75-FT. INTERVALS

some sections of Chicago's rapidly growing North Side, however, the reverse has been found to be true, and there is a reason.

The principal and most rapid means of transportation from the city's business district to North Side points along the lake is the elevated railroad, and between the tracks of this common carrier and Lake Michigan a large percentage of the available building space is occupied. The opposite side of the tracks, however, being further from the lake, is less desirable as a building site and, as the picture herewith shows, is yet a prairie in some places. Persons must cross this unimproved land, however, to reach homes at some distance from the elevated railroad, and on several of these streets the city has placed lighting posts and real-estate companies have laid cement sidewalks. These improvements make it safe for pedestrians to cross the untenanted areas at night, and the number of persons using such streets is made the determining factor in deciding which streets shall be lighted. Incidentally, real-estate companies profit by the addition of lighting in front of unimproved property, but they are in no way considered when extensions joining uninhabited territories are to be made.

Is There a Gift Room in Your Town?

A furniture store in a thriving Middle West town recently opened and advertised a "gift room" stocked with pieces of light furniture, art objects, and other appropriate household equipment. The advertising campaign exploiting the gift room was skilfully conducted, and it soon became apparent to other merchants in the city that people did not buy gifts until they had at least visited the gift room at the new furniture store. Even the man in charge of the electric shop in this modern little city has felt the furniture-store competition to some extent, and his opinion of the successful gift room as a sales idea is convincingly set forth in his own retrospective statement that the appliance sales of the electric-service company would have been a couple of thousand dollars higher last year if he, instead of the furniture man, "had been first to think of the gift-room stunt."

THE VALUE OF ADVERTISING*

Plea for More Liberal Use of Advertising Media and More Intelligent Publicity Campaigns

BY ARTHUR WILLIAMS, GENERAL INSPECTOR NEW YORK EDISON COMPANY

It seems to me very much like carrying coals to Newcastle to talk to Jovians upon any possible matter concerning the efficiency of our connected effort in strengthening the industry, in making it better and larger; but oftentimes you will find a closer degree of

FIG. 1—"SPHINX" POSTER OF ELECTRICAL SHOW

appreciation of the problems involved because of an understanding of those problems.

I have a very definite purpose in speaking on the subject "It Pays to Advertise," and that is to get you in that mental attitude where you feel as I feel, that when it comes to advertising which is direct, clean-cut and specific, the electric industry as a whole falls far short of what it should do in seeking to attain the highest ideals in the direction of an efficient and effective publicity. A great many people say to me that electric light is its own advertisement, or electric power, or the electric sign, and it would seem so; yet I find from personal experience that, though familiarity does not necessarily breed contempt, it does engender at times a certain degree of lack of observation.

In my mind the greatest competitor with which we have to contend as electric-light men is not oil, or candlelight, or gaslight, or old-fashioned methods as compared with more modern ones, but it is the dormant state of the average human mind, and the hardest thing to put in motion or to overcome in an effort to sell, which is the objective of any form of publicity, is human nature—first, to attract attention, which is comparatively easy; second, to secure recognition, which is a little harder but again comparatively easy, and then, third, to secure the action that produces the result.

I have frequently said that after the direct expenditure of hundreds of thousands of dollars for advertising in a technical sense I have never been able to see a single dollar of direct return. With that I have always coupled the statement that I have never failed to find a result. I know of several recent instances where advertisements in trade journals, speaking effectively and directly, and advertisements in the daily newspapers, speaking effectively and directly, have led to the substitution of one thing for another, the discarded thing not being advertised, and in these several instances there was a direct purpose which in each instance more than paid the cost of the advertisement. I am now convinced that those who are actually purchasing from day to day, if they analyze their actions, will find that the result of the purchase finds its cause in the advertisement.

*Abstract of an address made before the New York Jovian Electrical League, April 7, 1915.

Necessity of Action in Advertising

Advertising to be effective should also, in my opinion, contain action. It should suggest something in motion, some movement which will be infused into the mind of the person reading the advertisement. Let me give you two or three illustrations. Johnnie Walker whiskey is perhaps the most widely advertised whiskey at the present time, and if you analyze every advertisement of that corporation you find there is Johnnie Walker presumably always in action, with his cane under his arm, a smile on his face, and an intense interest in the thing that is illustrated. In the Wilson whiskey advertisements action is suggested by words. I make that distinction because a great many men who have articles to sell would say, "I cannot show my article in action," but you will notice that while the Wilson advertisement does not show anyone in action, it carries a phrase that suggests action. The phrase indicates action to your mind so that the thing becomes living, and in my opinion it impresses it all upon the mentality of the observer. A more direct illustration for electrical men is the poster of last year's Electrical Show featuring the Sphinx. To everybody the Sphinx means silence, and rest perhaps to a great many. But Cooper took the Sphinx, lifted the face a little, put a beautiful emerald green in the eyes, and then posed it looking at a very effective incandescent lamp, and it seemed to me that Cooper brought into our own industry, first, the best piece of poster work that has ever been done, emphasizing that advertising to be effective must be well done, and then he caught the very spirit of effective advertising and got harmony and proportion and, last but not least, a sense of intense action.

Cost of Advertising

It may be of interest to know that the advertising bill of the country is practically twice the income of all of the electric light and power stations of the country. That is to say, it amounts to nearly $700,000,000 to-day in this country, and the total income of our central stations I estimate to be about half that to-day. The manufacturers of the country are spending twice as much money as all of the people of the country are spending for electric light and power as supplied from central stations. There must be deduced the conviction that advertising pays, and pays well.

FIG. 2 — BELL TELEPHONE SIGN

Worth of Trade-Marks

The trade-mark has a value depending on the extent to which its appearance conveys something to the mind of the observer, and that value can be obtained only by publicity in one form or another. The Royal Baking Powder Company, for example, placed a value of $20,000,000 on that name, I am informed, and the National Biscuit Company, manufacturer of the "Uneeda" crackers, spends $600,000 a year on advertising. The latter company estimates the commercial value of its trade-mark at twice the total amount of money spent in advertising it. Can anybody estimate the value of the Bell telephone sign? If in no other way than this, that sign tells you where you will find a public telephone station when you want to communicate with somebody by telephone. Just think of the power of that sign in that respect alone, to say nothing of the fact that the Bell telephone stands for so much of efficiency and of service to the public.

I have been told that the little Edison man used by the New York Edison Company has been given a value

of $200,000. My answer was that I did not think the Edison man of the Edison company had any particular value in actually "putting over" a contract for electric service, but I thought it had a value far in excess of any such estimate in that it stands for good service and for a great organization always anxious and making an effort to do what it can in the service of the public of New York City. Or take the name of Edison. I do not think that anyone could estimate the value, the pulling power of Edison's name in selling electricity. I would not hesitate to place upon it a value of at least $20,000,000, and I do not think that is all sentiment. First, it stood for something new, something serviceable, and then it stood for a wonderful organization of human action devoted to serving the public. These few illustrations must convince you that advertising puts an intrinsic value in a material sense into such a thing as a trade-mark, and if in a trade-mark, how much more in the industry as a whole.

FIG. 3—EDISON MAN

In concluding, I want to make a very definite appeal, and that is that we shall get together and try to stir up our entire industry to a more liberal use of advertising media, and to do it individually and collectively. In my opinion, every business house should set aside a certain percentage of its income for advertising expenditure. Let it be even a small percentage at the beginning, but a definite percentage of income, bearing some fair proportion to the cost of selling in general, should be set aside for publicity, and in each instance the most effective way of reaching our own consuming public should be taken. That is 50 per cent of the problem of advertising.

Mystery of Cause and Effect in Advertising

How do you know when you spend your money for publicity that you are going to produce the result? What takes place between the payment for advertising on the one hand and the derived income from the sale of the product on the other? That action is just as mysterious to me as that which takes place between a dynamo and the lamp—we know the cause, we know the result, but what takes place? What takes place in the human mind between an expenditure for advertising and the effort to stir the mind up so that in a day or in a week or two one will be brought to purchase the thing I want him to purchase? That is to me one of the greatest problems of advertising, and naturally every one must try to solve that problem for himself; but my thought is that we ought to adopt, as a principle of our industry, that a certain definite and growing percentage of our receipts should be set aside for advertising exactly as we set aside a percentage of our receipts for any other purpose.

I greatly favor the advice of the expert. I think the advertising expert is just as important as any other expert connected with our industry. The man who understands forceful phrasing and the value of relative spaces, of pictures compared with type, of the sizes of type, of positions in papers, of the readers of papers; the man who understands, not your business, but the psychology of getting your business into the mind of the man that you want—to me it is just as important to have such a man in a corporation as it is to have a president or a treasurer or a secretary or a sales manager or a selling agent.

The selling man is greatly helped by the advertising—advertising is only a part of the entire story. Now I am speaking again of the technical advertising journals or the newspapers. It seems to me that the advertising prepares the way and the salesman follows it up, and he goes into a fertile field where advertising has been properly conducted. It has a further advantage; it seems to me you can sell more in comparison with cost. If you take your general selling cost and add to it the cost of advertising, you produce a larger result in sales effected than you would produce with the human selling cost alone, which, of course, in my mind is the predominant element of importance in the sale. But, more than that, through the advertisement, first of all, the manufacturer goes on record as to the quality of his goods; second, it is required that he keep that quality up, and in that way he carries out the promises that the selling man makes for his employer, and then, of course, indirectly—you will observe this without suggestion from me—where qualities are maintained and manuacturing and selling costs are reduced, the consumer—the public—which I think we should also have in mind, is very greatly served. So I make a strong appeal for a larger interest in advertising, for a larger appropriation and a more intelligent conducting of our publicity. I make a kind of appeal directly under this heading that will make the industry compare far more favorably than it does to-day with every other industry, particularly in manufacturing and selling lines—the automobile industry, the clothes-making industry and various others. Go through our journals and you will find almost an entire absence of the presence of electrical specialties. I think we can take a great deal of pleasure in such advertising as we see. Take that of the Westinghouse Electric & Manufacturing Company or the advertisement of the General Electric Company with Mr. Edison on a lamp in competition with the sun. I was very much impressed by the advertisement of the Westinghouse company carrying modern devices into the home, modernizing the home and eliminating the household drudgery which so quickly causes the women of to-day to break down in health. I have only picked out these three or four examples as an indication of what can be done, and I think we should, and I hope we will, in the belief that advertising pays, obtain a more concentrated individual and collective effort in that direction.

A 6300-hp Electric-Heating Company

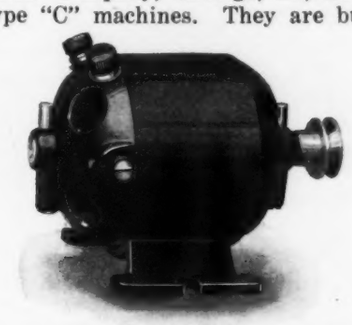
The Willys-Overland Company of Toledo, Ohio, as announced before, has contracted with the Toledo Railways & Light Company for approximately 6300 hp of additional electric service to be used in heating eighteen of its enameling ovens formerly heated by gas and by steam. In the ovens, which are now being slightly remodeled, the average electrical installation will consist of twenty-four 11-kw heating units. Each average-sized oven will therefore represent an electrical load of 264 kw, and the rating of its battery will be 4752 kw.

The change, it is said, was not made in an effort to reduce fuel cost in the heating operation but because electric heat will eliminate the possibility of explosion in the ovens, reduce the time of baking, and increase the quality of the product. It is estimated that a time saving of 33 per cent on the first coat of enamel and of 40 per cent on the second coat will be made, effecting a total time reduction of one and one-half hours in what has been a four-hour process. The contract was closed for the Toledo central-station company by Mr. H. O. Loebell, industrial heating engineer for H. L. Doherty & Company, and Mr. F. J. Derge, manager of the lighting and power department of the Toledo Railways & Light Company. The heating units for the ovens are being supplied by the General Electric Company.

NEW APPARATUS AND APPLIANCES

Fractional Horse-Power Motors

Motors for alternating-current and direct-current service have recently been placed on the market by the Bodine Electric Company, Chicago, Ill., and are designated as type "C" machines. They are built in sizes



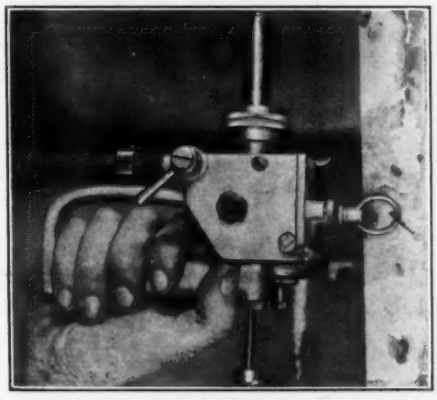
SMALL SERIES-WOUND MOTOR

with ratings ranging from 0.01 hp to 0.1 hp. The performance characteristics of the direct-current motors at full load are practically identical with the alternating-current motors under similar operating conditions. The shell and covers are die-cast, and the base is separable from the shell of the motor. The shaft is of steel, is accurately ground to size and runs in bronze bushings.

Applying Metallic Coatings by the Spray Process

Carbon commutator brushes may be coated with copper, wooden objects covered with a metallic envelope, and a variety of other novel operations of "spraying on" metal performed by means of an ingenious "pistol" mechanism now being introduced into this country under the Schoop patents by the Metals Coating Company of America, People's Gas Building, Chicago. The process has also been suggested for depositing resistance laminas of any thickness on metals, for building up commutators of any desired shape, and for galvanizing sheet metal and metal castings.

The casting metal is fed into the pistol in the form of wire which, on traversing the flame zone a short distance back of the nozzle, is converted into spray in the intense heat of an oxy-hydrogen flame. This me-



METAL-SPRAYING PISTOL FOR COATING CARBON BRUSHES, ETC.

tallic spray leaves the nozzle at a temperature of from 700 deg. to 2000 deg. Fahr., but may be directed, with perfect assurance against scorching, onto even the most inflammable substance at a distance of a few inches. The sprayed metal covers the surface uniformly and tenaciously, and can be built up to any desired density. It may be deposited on metal, wood, stone, paper or cloth. Lead, tin, zinc, copper, bronze, brass, German silver alloy, steel, gold, silver and aluminum may be used as the coating material, several different metals even being applied on the same object. A metal coating averaging 0.001 in. thick can be deposited at the rate of 1 sq. ft. per minute, it is said, at a cost of about 2 cents per sq. ft. The hand instrument is readily portable, weighing only 3.5 lb.

Shade Holder

A 4-in. shade holder which has recently been developed and which is designed for use with brass-shell "mogul" base sockets is shown in the accompanying illustration. The holder is attached to the socket by a clamp-and-screw arrangement which is said to provide

SHADE HOLDER FOR HIGH-EFFICIENCY INCANDESCENT LAMP

rigid center suspension for shades of any size. The clamp grips the socket above the bead. Twelve openings around the top are provided for ventilation, as shown in the illustration, thus making the device adapted for use with nitrogen-filled lamps. The shade holder is being placed on the market by Harvey Hubbell, Inc., Bridgeport, Conn.

Charging Plugs and Receptacles for Electric-Vehicle Service

A number of different types of charging plugs and receptacles have been developed by the Albert & J. M. Anderson Manufacturing Company, 289 A Street, Boston, Mass., for electric-vehicle service. In Fig. 1 is shown a charging receptacle for switchboard mounting designated as a type N device. The receptacle is equipped with a collar and a clamping nut for fastening it on the panel. The metal parts which show on the front

FIGS. 1 AND 2—CHARGING RECEPTACLES FOR SWITCH MOUNTING AND FOR SUSPENDING CABLE FROM CEILING

of the board are copper-plated and are provided with a polished finish.

The receptacle illustrated in Fig. 2 is designed for suspending the cable from ceilings. The receptacle is equipped with a threaded cap and cable clamp which

takes all strain from the soldered connections. It can be used for connecting motors and portable electric machines to the circuit. The over-all length of the receptacle with cap is 5⅛ in. and its net weight is 1.5 lb.

The charging plug shown in Fig. 3 is a double-pole device and is rated at 150 amp at 125 volts. It is provided with a steel shell which fits closely into the cylindrical shell of the receptacle. The plug is equipped with

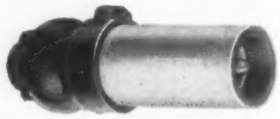


FIG. 3—CHARGING PLUG WITH SHORT HANDLE

detachable lugs so that soldered connections can be made. The iron handle is provided with a special cable clamp which prevents injury to the insulation on the cable and relieves the soldered connection of mechanical strain. The plug may be equipped with a long or a short handle. The over-all length with the long handle is 10.25 in. and with the short handle 7.25 in. The weight of the plug with the long handle is 4.5 lb. and with the short handle 3.5 lb.

Oil Switch with Fuse Terminals

An oil switch which is equipped with fuse terminals inside the switch frame and which is designed particularly for use with small induction motors whose ratings do not exceed 25 amp has been developed by the Condit Electrical Manufacturing Company, Boston, Mass. The switch, which is designated as the type ID oil switch, is made for both 250-volt and 600-volt service and is totally inclosed. Both the moving and stationary contacts are reversible and renewable, the reversible feature, it is said, affording long life.

The oil tank is securely fastened to the main frame but is so arranged as to be readily removable for inspection of the contacts. Separate compartments are provided for the fuses and the contacts. The operating handle swings close to the switch frame, thereby reducing to a minimum the danger of throwing the switch in or out by accidentally striking against the handle. Stops on the frame prevent the handle from being thrown too far either in the "off" or the "on" direction, and these positions are clearly marked on the frame.

Use is made of "Shawmut" fuse clips, which are

OIL SWITCH WITH FUSE TERMINALS INSIDE THE FRAME

mounted on insulating blocks supported on the top of the switch frame. The cover fits closely over the top of the main frame and is securely held in place, although it may be easily removed to replace the fuses. The switch is arranged for mounting on the wall.

Fixture for Nitrogen-Filled Lamps

In the accompanying illustration is shown a fixture developed by the Faries Manufacturing Company, Decatur, Ill., which is designed for use with 100-watt, 200-watt or 300-watt nitrogen-filled lamps. The holder, which is reinforced with a steep supporting saddle so

LIGHTING UNIT FOR 100-WATT, 200-WATT AND 300-WATT NITROGEN-FILLED LAMP

that no weight is placed on the socket, is of heavy sheet copper and is provided with a frosted aluminum reflecting surface. The canopy and hanger are of brass. Use is made of the so-called dual ventilating system. The holder is designed for a 6-in. glass fitter and is employed with a standard socket. The unit is designated by the above manufacturers as the "Farieslite" fixture No. 3293.

Inclosed Fuse

A fuse of the inclosed type, a sectional view of which is shown in Fig. 1 and an outside view in Fig. 2, has recently been developed by the Chelten Electric Company, 314 Armat Street, Philadelphia, Pa. According to

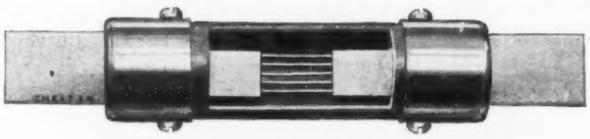


FIG. 1—SECTIONAL VIEW OF FUSE

the manufacturers, the fuse is of uniform rating and at normal temperatures will carry indefinitely 10 per cent greater load than that at which it is rated. It is designed to blow uniformly at 17.5 per cent overload. The fuse strip is of round wire drawn through a die. Fuses

FIG. 2—10-AMP INCLOSED FUSE

with ratings of 35 amp or more are equipped with a fuse element consisting of three parts—two "lead-in" strips of flat fusible material and the center fuse strip or strips connected to the "lead-in" strips. The round-center strips determine the rating of the blowing of the

fuse at overload, but on a short-circuit both the center and "lead-in" strips blow, therefore increasing, it is declared, the arcing distance and thus making it easier for the "filler" to extinguish the arc. The fuse is made in various standard ratings up to and including 600 amp, in both the 250-volt and 600-volt type.

Interior Fire-Alarm System

Interior fire-alarm apparatus designed particularly for operation in New York City and New York State, in accordance with certain labor laws and the requirements of the State Industrial Board and the New York City Bureau of Fire Prevention, has been developed by the Autocall Company, Shelby, Ohio. The system is of the closed-circuit type and operates on 110-volt direct current.

In Fig. 1 is shown a demonstrating oufit mounted on a display board, which includes the control board, fire box, fire bell and fused resistance coil with wiring diagram and printed instructions which are furnished with each system. The alarm boxes and the solenoid are on a closed circuit across the 110-volt mains. The gongs and trouble-bell relay are also on a closed circuit across these mains. Resistance in these circuits limits the current to approximately 65 milliamperes per circuit. The small cabinet shown at the left in Fig. 1 contains fused resistors which are wired in the bell circuit to protect the circuit against a large continuous flow of energy in case of accidental interruption to the box circuit. At the bottom of the control board is shown a small box which contains a circuit-shifting relay. With improved systems this relay has been eliminated by adding another solenoid to the control board.

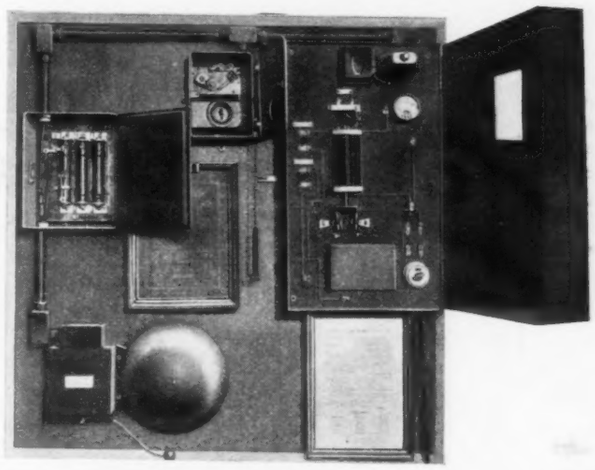


FIG. 1—FIRE-SIGNAL SYSTEM MOUNTED ON DISPLAY BOARD

To sound an alarm the glass in one of the alarm boxes is broken, thus releasing the signal mechanism. As the sector or break wheel revolves, the teeth operate the contact springs and open the circuit. The solenoid *A* in Fig. 2 is de-energized, and the armature *B* drops across the carbon contact *C*, thus connecting the gongs to the 110-volt circuit, causing them to strike. When the circuit is again closed in the box the solenoid *A* is re-energized. During the sounding of an alarm an annunciator on front of the alarm box drops, which indicates that the box is inoperative until "reset." In setting the alarm box again the annunciator flap is brought to an upright position and the latch on the inside of the door is engaged with the annunciator pin. In sounding an alarm the movement of the alarm box is allowed to run down completely before rewinding. An open box or gong circuit is provided which will cause the trouble bell on the control panel to ring continuously. This bell is operated by four dry cells.

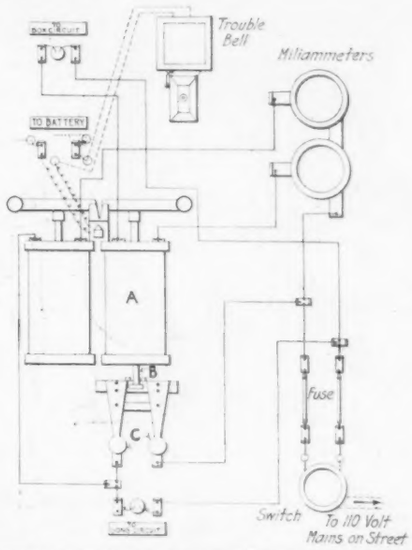


FIG. 2—WIRING DIAGRAM FOR 110-VOLT DIRECT-CURRENT FIRE-ALARM SYSTEM

The system, as approved, is on display at the office of the State Industrial Board, New York. According to the manufacturers, the apparatus is the first system approved by the supervising authorities for operation on 110-volt direct-current underground circuits in New York City.

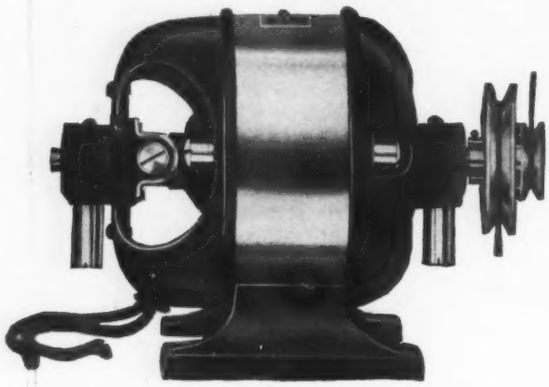
Charging Equipment for Garage

The charging equipment of the Corey Hill Garage, Brookline, Mass., shown in the accompanying illustration consists of a Wagner rotary converter and charging panel with four unit-type rheostats made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. The outfit is operated on single-phase alternating current. The leads are carried from the charging rheostat to the outlet in conduit which is shown running on the wall parallel with and about 3 ft. above the floor. The rheostat handles are within easy reach, as shown, and are arranged for charging one or two and three or four electric cars at the same time from the one location. Protection is provided against overcharging and against charging back into the line. There is an instrument switch on each panel, so that the voltage of any battery being charged can be read at any time desired. The rheostat units and panels for the above installation were completely wired before being installed.

BATTERY-CHARGING OUTFIT

Fractional-Horse-Power Motors

Motors for alternating current and direct current with ratings of 1/20 hp and 1/16 hp have been developed by the Knapp Electric & Novelty Company, 511 West Fifty-first Street, New York. Both types of motors operate



SMALL MOTOR WITH REMOVABLE FEET

on 110 volts. The shaft of the 1/20-hp machine is 6⅛ in. long and that of the 1/16-hp machine 7 in. The feet can be readily removed when economy of space is desired. The field structure of the motor consists of two laminated poles, the armature is also laminated and has fourteen slots; it is 2 in. in diameter. Use is made of a shaft which is 9/32 in. in diameter and a cone pulley which has an inside diameter of 1 in. and an outside diameter of 1.5 in. The commutators are of copper and consist of fourteen segments with mica insulation. Wick-feed oil cups are employed. The body of the motor is 4.25 in. in diameter and the finish of the machine is of black enamel with brass trimmings. The shipping weight of the 1/20-hp motor is 6.25 lb.; without the base it is 5.5 lb. The shipping weight of the 1/16-hp machine is 8.5 lb., and without the base it is 7 lb.

Improved Steel-Plate Fan

The "Buffalo Planoidal" fan, as it is called, shown in the accompanying illustration is, according to the manufacturers, a modification of the paddle-wheel fan and is adaptable for use where economy of space and high

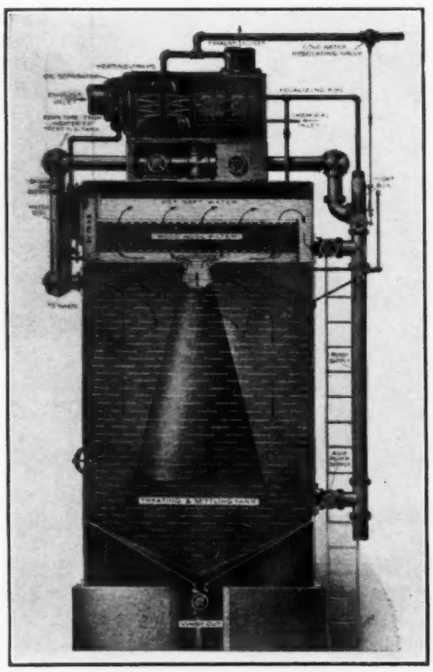
FULL-HOUSING FAN, WITH BOTTOM HORIZONTAL DISCHARGE

speeds are not necessary. The housing is of heavy steel plate and is involute in form. The blast wheel is equipped with from five to twelve radial blades, depending on the size of the fan. The blades are of heavy steel plate and are riveted to T-iron spider arms, which are cast into a heavy hub and are tapering in shape, being wider at the inlet than at the periphery. The side sheets of the wheel are flanged at the inlet and are riveted to the sides of the blades.

The fans are built both as exhausters and blowers, the construction for each being identical except that the blowers have two inlets of smaller diameter than the one inlet of the exhauster and are not provided with an inlet cone. The inlet cone of the exhauster tapers toward the inlet of the blast wheel and causes the velocity of the entering air gradually to increase, thereby reducing, it is declared, the loss at this point. Double-width fans, which give twice the capacity of a single-width fan, are built only as blowers and are provided with two inlets. The fans are being made by the Buffalo Forge Company, Buffalo, N. Y.

Hot-Process Water-Softening Apparatus

The apparatus shown in the illustration is a combination open feed-water heater and a chemical water-softening system. The water is passed through a steam bath in the heater chamber, and as a result air and



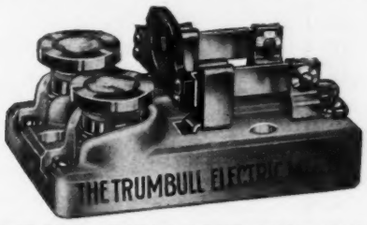
APPARATUS FOR SOFTENING WATER

gases are driven out of the water. As the water passes from the heating chamber, the chemical reagent is introduced in proportion to the amount of water and the impurities which it contains. After the introduction of the chemical, the water passes into a cylindrical steel-plate treating and softening chamber, the course of the water being gradually downward in order to obviate convection currents. The precipitate and sludge rapidly form and settle to the bottom of the tank, which is conical and is provided with a blow-off valve so that the sludge may be quickly disposed of by periodical blowing. After having been clarified by sedimentation, the water passes up through a wood-wool filter which is designed to arrest any small particles which may not have been eliminated in the settling chambers.

The Sorge-Cochrane hot-process system described above has been developed by the Harrison Safety Boiler Works, Seventeenth Street and Allegheny Avenue, Philadelphia, Pa.

Combination Cut-Out Switch

Although the base of the cut-out switch shown in the accompanying illustration is rather high, it is hollowed out on the back so that it is comparatively light in weight. The switch is equipped with a spade handle which is provided with a fiber cross-bar. Use is made of

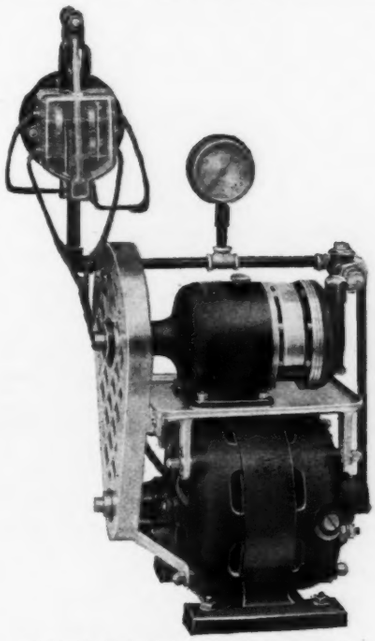


CUT-OUT SWITCH WITH HIGH BASE

hinge bolts which are spun over and therefore cannot work loose. The "double U" clip is self-adjusting and is of heavy copper; if it gets bent, it can be straightened by a blow of the hammer. The switch stands high enough so that in throwing it over the fuses offer no obstructions. The switch, which has been developed by the Trumbull Electric Manufacturing Company, Plainfield, Conn., can be placed in a box 3 in. deep.

Small Motor-Driven Air Compressor

The air compressor shown herewith is air-cooled and rotary-driven and is equipped with eight 1-in. cylinders. The rotary motion is converted into a reciprocatory motion by a connecting-rod rocker which is pivoted on a universal joint. The smaller end of the connecting-rod rocker is engaged to the crank shaft a sufficient distance from its center to permit a 1 5/16-in. stroke. There is a ¼-in. lead between the pistons which insures, it is declared, a continuous flow of air and a steady pull on the driving arm. The driving arm or crank shaft has a counterbalanced weight to offset the rocker, there-



ROTARY-DRIVEN AIR COMPRESSOR

by, it is claimed, eliminating all vibration. A small blade attached to the crank shafts dashes oil over all moving parts. There is one discharge valve for each cylinder and all valves are mounted on one plate. The valves are of brass, cylindrical in shape, and are not ground, but peened. The valves lift only 0.01 in. off their seats. The intake is through a stationary port which is cut in each of the cylinders which are cast en bloc. The compressor proper consists of four semi-steel castings. Each piston carries two cast-iron rings and is fitted with oil grooves. The connecting rods are 2 1-16 in. in length, and have a ⅝-in. hardened-steel ball at each end. In its entire travel the free end of the connecting rod moves only ⅛ in. out of a straight line. The machine is operated by a 0.5-hp motor and is driven by means of a silent chain. The over-all dimensions are: length, 14 in.; width, 9 in.; height, 18 in., and the total weight is 110 lb. The compressor is being made by the Utility Compressor Company, Detroit, Mich.

Belt-Treating Compound

A compound for treating belts and ropes made by the Cling-Surface Company, Buffalo, N. Y., has been improved so that it is unnecessary to heat the product when used at temperatures of 60 deg. Fahr. or above. The material is semi-fluid at ordinary temperatures and can be applied to the belt with a strip of wood, thus eliminating the danger which would exist if it were applied directly by hand.

Electrically Operated Chimes

As noted in the ELECTRICAL WORLD of March 20, the Betts & Betts Corporation, 256 West Fifty-sixth Street,

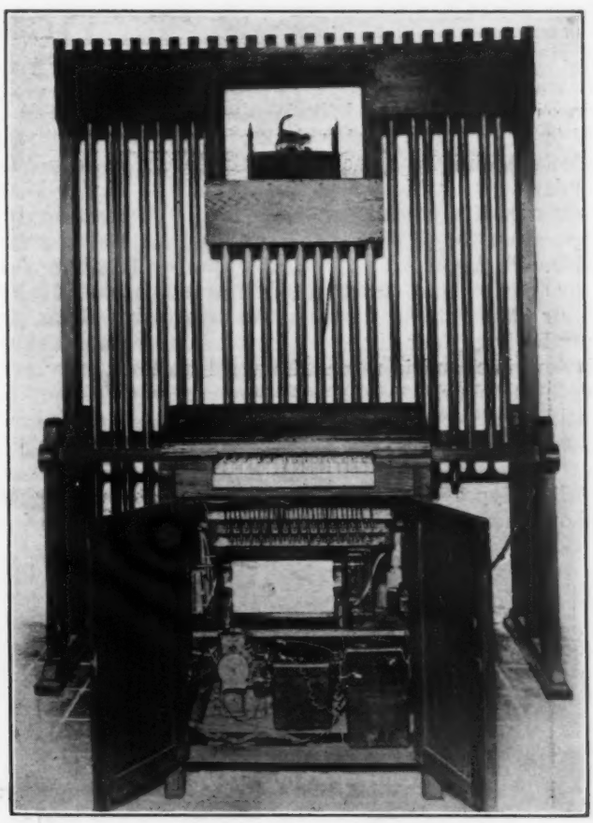


FIG. 1—AUTOMATIC CHIME-PLAYING OUTFIT

New York, is making electrically operated chimes of various types and has engaged the services of Mr. H. A. Yerkes, who is an inventor of electric chimes and bells for amusement places.

Under Mr. Yerkes' supervision chimes of all sizes are

being manufactured, from small clock chimes to large chimes for church towers and outdoor use. Apparatus has been designed for playing chimes automatically by means of a master clock from music rolls which can be changed as often as desired. In Fig. 1 is shown an automatic outfit for playing the chimes from a roll, and

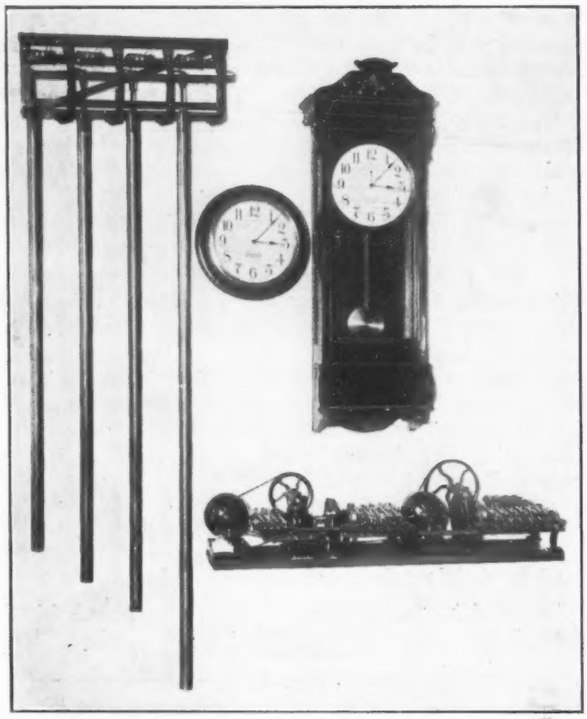
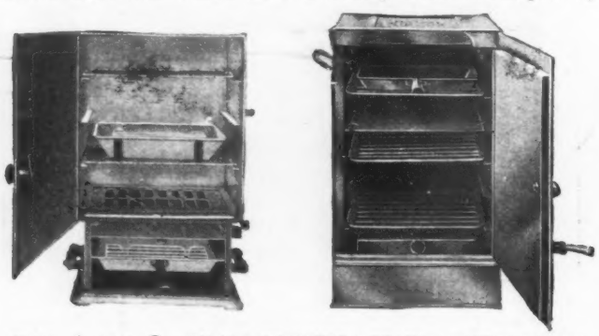


FIG. 2—WESTMINSTER CHIME OUTFIT

in Fig. 2 is illustrated the Westminster chime outfit, as it is called. The master clock of the latter outfit sends electrical impulses once each minute to the round secondary clock, which keeps in step with it. Every fifteen minutes the secondary clock sets a mechanism into operation for playing the chimes and causes the proper solenoid magnets to operate the proper hammers. At the quarter hour the chimes are played once, at the half hour twice, at the three-quarter hour three times, and at the hour four times. A chord is also played at the latter time, and is repeated several times to correspond with the hour.

Small Electric Stoves

Two types of small electrically operated stoves are shown herewith which have recently been developed by



FIGS. 1 AND 2—SMALL ELECTRIC STOVES WITH OVENS

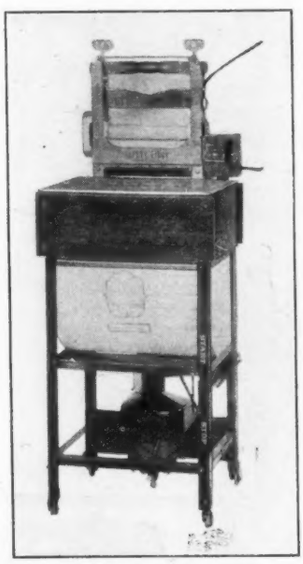
the General Electric Company, Ltd., 67 Queen Victoria Street, London, E. C., England. The stoves are of sheet-metal construction and are provided with rigid angle-iron frames.

The size of the cooking space in the stove shown in Fig. 1 is 12 in. by 12 in. by 9 in. The oven fits on the top of a hot-plate and grill and is held in place by two retaining screws. The maximum rating of the stove is 1500 watts. By means of a polished reflector plate, which can be placed under the heating element if no heat for grilling is required, all the heat from the element is directed up into the oven.

The size of the cooking space in the stove shown in Fig. 2 is 15 in. by 12 in. by 12 in., while the over-all dimensions are 22.5 in. by 14 in. by 14 in. The stove is of double-wall construction. There is a heating element rated at 800 watts at the bottom of the oven, and another at the top. The top element is arranged in two circuits, each circuit being rated at 700 watts. The stove can be arranged to take 200, 700, 800, 900, 1400, 1500, 1600 or 2200 watts as desired.

Motor-Driven Washer of Household Size

An electrically operated washing machine in which there is no mechanical connection between the driving motor and the revolving clothes drum has been brought out by the Capital Electric Company of 321 North Sheldon Street, Chicago, Ill. The motor is mounted vertically beneath the tub and drives a 4.5-in. propeller blade in the bottom of the tub through a flexible coupling and a clutch. This propeller, revolving at motor speed, which is 1700 r.p.m., drives a stream of water upward through the clothes. The clothes drum being



ELECTRIC WASHER WITH NO MECHANICAL CONNECTION BETWEEN MOTOR AND REVOLVING DRUM

free to revolve on its axis is turned by the force of the water impinging against it. To hold the clothes drum steady it can be locked either down in running position or up in position to receive clothes from the wringer. It is not necessary for the operator to place his hands in the water to lift the drum from either of these positions. The reversible wringer above the tub is equipped with a safety stop device and is driven from the motor through shafting and a forty-eight-to-one gear reduction. The washer may be equipped with either a galvanized or a copper tub, and it measures 22 in. wide by 28.5 in. deep by 53 in. high. The machine is designed to wash six sheets or the equivalent at one time. The vertical driving motors are made by the Fort Wayne Works of the General Electric Company, Fort Wayne, Ind., and are installed under cast-iron housings.

CURRENT NEWS SECTION

Electrical Prosperity Week

An appropriation which will be sufficient to insure the advertising of "Electrical Prosperity Week" in every city and town in the country was recommended by the "Electrical Prosperity Week" committee, which met on April 7 at the Engineers' Club, New York. This recommendation will be submitted to the board of directors of the Society for Electrical Development for approval on April 19.

The committee's recommendation on plans carried with it an appropriation of $50,000 for special expenditures, such as printing, and extraordinary expenses. In addition the society will devote a large part of its regular appropriation to the work. It is understood that the plans for the campaign and the knowledge that it will be handled by the society, under the general guidance of the executive committee, have stimulated the society's growth in membership, particularly in central-station members.

While the Society for Electrical Development will handle the details of the movement and spend a large sum of money in carrying on the campaign, leading electrical manufacturers and jobbers have declared their intention of making liberal expenditures for national publicity. Each company will tie its campaign in with the society's co-operative movement. Central stations, contractors and dealers will take advantage of the national campaign to obtain local results by handling sales campaigns of their own during the week.

The sub-committee appointed at the meeting on March 24 reported to the executive committee that it had definitely decided upon "Electrical Prosperity Week" as being the most appropriate, euphonious and expedient designation. Many names were considered, but in order to make this campaign one that would prove popular with the average layman, it was the opinion of the committee that no better name could be suggested than that given it at the time the campaign was first discussed. It was under the name of "Electrical Prosperity Week" that it received great publicity in metropolitan and other newspapers and was brought to the attention of the public. The name has met with general satisfaction and was unanimously approved.

The committee definitely selected the week from Monday, Nov. 29, to Saturday, Dec. 4, 1915. This selection also met with the approval of the representatives of the various interests. It was pointed out that it will furnish the impetus for a "shop early" sales campaign for Christmas electrical goods, and that it is particularly pleasing to the department store managers and merchants, since they will have a chance to begin their extra illumination earlier and to allow it to continue without a break until Christmas. Central stations will benefit greatly because the merchants will not feel disposed to return to less efficient illumination.

The committee recognized the fact that the society must necessarily receive the assistance of experts along certain lines of endeavor. Advisory committees, to work with the society in determining policies and other important matters, were appointed, composed of the following men, though additional names will probably be added later:

Committee on general publicity—Messrs. H. W. Alexander, manager department of publicity Society for Electrical Development; L. D. Gibbs, superintendent advertising department Edison Electric Illuminating Company of Boston; George Williams, commercial manager Henry L. Doherty & Company; D. H. Howard, publicity manager Commonwealth Edison Company, Chicago; W. H. Hodge, publicity manager H. M. Byllesby Company, Chicago; Norman Macbeth, publisher *Lighting Journal*, New York; Frederic Nicholas, associate editor ELECTRICAL WORLD, New York; E. R. Kelsey, manager publicity department Toledo Railways & Light Company, Toledo, Ohio, and Don C. Shafer, advertising department General Electric Company, Schenectady, N. Y.

Committee on advertising—Messrs. J. M. Wakeman, general manager Society for Electrical Development; Frank H. Gale, advertising manager General Electric Company, Schenectady, N. Y.; J. C. McQuiston, manager Westinghouse department of publicity, East Pittsburgh, Pa.; N. H. Boynton, manager department of publicity National Lamp Works, Cleveland, Ohio; T. G. Whaling, Westinghouse Lamp Company, New York; Howard K. Mohr, advertising manager Philadelphia Electric Company, Philadelphia, Pa.; T. J. McManis, manager publicity department Edison Lamp Works, Harrison, N. J.; Thomas R. Elcock, advertising manager United Gas Improvement Company, Philadelphia, Pa.; P. L. Thomson, advertising manager Western Electric Company, New York, and Joseph L. Sullivan, sales manager Franz Premier Company, Cleveland, Ohio.

Committee on exhibitions, lectures, parades, etc.—Messrs. George B. Muldaur, Society for Electrical Development; E. W. Lloyd, general contract agent Commonwealth Edison Company, Chicago, Ill.; P. L. Thomson, advertising manager Western Electric Company, New York; F. Nelson Carle, advertising manager General Vehicle Company, Long Island City, N. Y.; Frank B. Rae, Jr., *Electrical Merchandise*, New York; Ray D. Lillibridge, advertising agent, New York; H. N. McConnell, commercial manager United Gas & Electric Company, New York; A. J. Marshall, secretary Electric Vehicle Association of America, New York; E. A. Edkins, Commonwealth Edison Company, Chicago, Ill.; Frank H. Gale, advertising manager General Electric Company, Schenectady, N. Y.; J. C. McQuiston, manager Westinghouse department of publicity, East Pittsburgh, Pa., and Homer E. Niesz, Commonwealth Edison Company, Chicago, Ill.

Committee on local illumination and display—Messrs. A. J. Edgell, display manager Society for Electrical Development; T. I. Jones, general sales agent Edison Electric Illuminating Company, Brooklyn, N. Y.; W. R. Huntley, Buffalo General Electric Company, Buffalo, N. Y.; Joseph D. Israel, commercial manager Philadelphia Electric Company, Philadelphia, Pa.; M. O. Dellplain, Syracuse Lighting Company, Syracuse, N. Y.; E. R. Davenport, sales manager Narragansett Electric Lighting Company, Providence, R. I.; C. G. Durfee, Rochester Railway & Light Company, Rochester, N. Y.; Howard A. Lewis, Hotpoint Electric Heating Company, Chicago, Ill.; A. A. Gray, managing editor *Electrical Review*, Chicago, Ill.; H. C. Menefee, editor *Signs of the Times*, Cincinnati, Ohio, and J. H. Donnelly, editor and publisher *Electric Sign Journal*, New York, N. Y.

Local committees will be appointed to co-operate in

the movement. The names of the prominent men selected by the executive committee will be announced later. The following resolution was passed by the executive committee:

"Resolved, that the nominating committee's recommendations as to local committees to take charge of 'Electrical Prosperity Week' be approved, with the understanding that these committees are authorized to add to their personnel, and that the general manager define the districts covered by each of these committees when notification is sent to these committees."

At the conclusion of the meeting the committee members present expressed their approval of the preliminary plans for the week, and also of the work of the society in this connection up to the present. It was recognized that the electrical industry had embarked upon the greatest campaign in trade history, and one which would be of untold benefit, both from the point of actual sales and in publicity. It is reported that to cover all costs fully half a million dollars will be spent before its close.

Watson on the Telephone

At a meeting of the New York Electrical Society held at the Engineering Societies Building on April 14, Mr. Thomas A. Watson delivered a popular lecture on "The Birth and Babyhood of the Telephone." It was ladies' night, and musical selections were rendered as a part of the evening's entertainment. Previous to the lecture of the evening Messrs. Alexander Graham Bell, Thomas A. Watson, Michael I. Pupin and J. J. Carty, the four men most closely associated with the development of telephony, were elected honorary members to the society. It was estimated that approximately 1000 people heard Mr. Watson's lecture.

Chicago's Mayor-Elect Favors Local Regulation for Utilities

At a hearing held by the Illinois Legislature's house committee on public utilities and transportation at Chicago, April 9, Mr. William Hale Thompson, Mayor-elect of Chicago, expressed himself in favor of "home rule" of Chicago's utilities and declared that he would do all in his power as Mayor to restore such local regulation. Messrs. Samuel Insull, president of the Commonwealth Edison Company, and B. E. Sunny, president of the Chicago Telephone Company, testified in favor of continuing the present system of state regulation. Mr. Insull pointed out that it would be less economical to produce electricity to be used only within the city limits of Chicago, and that regulation by the city authorities would be a step backward. While declaring himself a believer in regulation, he said that the multiplication of regulatory bodies might impose expense burdens on the utility corporations and so tend actually to increase the cost of service to customers.

Mr. Sunny explained that with the short two-year term for which city councilmen are elected a city council lacks the experience of a permanent commission of experts. A recent council investigation of the telephone company's rates, he cited, required three years to complete. Mr. Sunny declared that the two-year experience of councilmen does not qualify them to handle the technical questions involved in modern utility cases. Prof. E. W. Bemis, the city's representative on the board of supervising engineers, said that most of the questions involved in regulation concern matters of policy rather than engineering, and declared himself in favor of a commission close to the community.

Mr. Byllesby on Commission Regulation

A commission or other regulatory body which has the power to regulate public utilities should also regulate the taxation of such utility corporations on the basis of a rational valuation, declared Mr. H. M. Byllesby, president of H. M. Byllesby & Company, Chicago, in speaking before the Chicago Electric Club, April 8, on the topic "Practical Results of Utility Regulation by Public Service Commissions." There are, however, no commissions which combine both the regulatory and taxation functions. The legal body which has the power to fix the rate of return which a utility may earn should make its valuation on a fair basis, taking into consideration the obsolescence of machinery which has marked the rapid development of the electrical industry, and the cost in "brains, money and heartaches" which has been necessary to bring many utilities into earning condition.

But commissions are fair-minded and honest, declared Mr. Byllesby, and such a small tribunal of honest and fair-minded men is to be infinitely preferred to the old-time city councils and state legislatures. Commissions are often closely limited by the laws which create them and which govern their action. The failure to provide commission control over taxation Mr. Byllesby characterized as lamentable. A commission may by fair and wise rulings improve the earning condition of a utility under its charge, only to have that utility mulcted to a greater extent by an independent taxing body. The speaker holds the view that utility commissioners should be appointed for life and good behavior in order to remove them from local political considerations and influence.

Report on Cleveland Municipal Plant

Bulletin No. 1 of a proposed series on the Cleveland municipal plant has been issued by Mr. F. W. Ballard, commissioner and chief engineer, who says in part:

"Our rating is only 24,000 kw, which is practically one-fourth that of the Cleveland Electric Illuminating Company, and we could not, and it is not our intention to, take the entire lighting and power load of the city of Cleveland. However, the rating is entirely adequate to demonstrate the commercial possibilities of making energy for lighting and motor service at a maximum rate of not to exceed 3 cents per kw-hr. This should result in the Cleveland Electric Illuminating Company either reducing rates to meet ours or selling its plant to the city of Cleveland.

"The territory covered by the municipal plant has a greater area in proportion to the size of our station than has the area covered by the Cleveland Electric Illuminating Company, considering the capacity of the company. Also the average size of the customers that we are serving is less than is the average size of those being supplied by the Cleveland Electric Illuminating Company. In other words, the company has the large and more profitable consumers, and we have the smaller and less profitable customers, and we are making a profit upon these, although our rates are less than one-half the rates of the Cleveland Electric Illuminating Company.

"We have now 10,000 customers, and our plant is only one-fourth loaded. Evidently when we have loaded up our plant to the total number of customers we can carry, we shall have 40,000. The Cleveland Electric Illuminating Company now has approximately 72,000 customers, and with a capacity of four times that of the municipal lighting plant it should have approximately 160,000 customers in order that the average size of its customers might be as small as that of our cus-

tomers. The average size of the Cleveland Electric Illuminating Company's customers is, therefore, practically double the average size of the customers on the municipal lighting plant."

I. E. S. Affairs

At a meeting of the council of the Illuminating Engineering Society held in New York on April 8 the committee on membership, of which Mr. D. McFarlan Moore is chairman, reported that 117 applications for individual membership had been received since Oct. 1.

The committee on lighting legislation, Mr. L. B. Marks chairman, reported that it had considered (1) a report containing material for formulating a code on factory lighting, which had been received from the committee on factory lighting, and (2) a report submitted by the committee on school lighting containing material upon which it is proposed to base a code on school lighting. The committee on lighting legislation will disseminate data and reports among legislative bodies, school boards, public service commissions and other bodies or individuals who may be or should be interested in enactments, rules and regulations for better lighting.

The committee on reciprocal relations with other societies, Mr. W. J. Serrill chairman, reported that it is continuing its efforts to popularize the work of the society among those organizations which are believed to be interested in the better illumination propaganda. For this purpose the society has available for loan to lecturers slides and printed lectures on school lighting and on some fundamental principles of illumination.

The committee on glare, Dr. P. G. Nutting chairman, submitted two of a series of ten reports being prepared by the committee. One of these contained a discussion of the nomenclature and the physical theory of diffusion, while the other dealt with instruments and methods for measuring diffusion and the theory of diffusion photometry.

The 1915 convention of the society will be held at the New Willard Hotel, Washington, D. C., from Sept. 20 to 23, inclusive. Mr. E. S. Marlow is chairman of the convention committee.

Testimony on Telegraph Company Wages

At a hearing before the United States Commission on Industrial Relations in Chicago on April 11, testimony was given by Mr. Newcomb Carlton, president of the Western Union Telegraph Company. Mr. Carlton expressed his belief that telegraph operators are underpaid. A first-class telegrapher should be able to earn at least $5 a day for nine hours. He said that the company has one of the best pension and relief organizations in the country, and it is conducted without expense to the employees. Since the company is subject to the Interstate Commerce Commission, which regulates practices as well as rates, Mr. Carlton believes that the commission should have sufficient power to see that fair wages are paid and fair working conditions are provided.

In reply to questions by Chairman Walsh of the commission, Mr. Carlton expressed his belief in the organization of labor and in collective bargaining if the organization with which dealings are conducted is a responsible one. He said that in the five years during which he has been with the company there has been no union of telegraphers which he has considered qualified to represent them.

Mr. Belvidere Brooks, vice-president of the Western Union Telegraph Company, testified before the commission on April 13. He said that thirty years ago the company opposed the telegraphers' union, but just prior obtained. An example was quoted in which the value to 1907, when a strike was called which cost the company $5,000,000, the union was rejuvenated and the company made no protest. Then reports of a strike were heard and the company offered arbitration. An agreement was supposed to have been reached, but on the day following a strike was called in San Francisco which spread eventually all over the country. Since then the company has not cared to employ men interested in the union.

Gearless Traction Elevators

Mr. David Linquist, chief engineer of the Otis Elevator Company, presented a very instructive paper entitled "Modern Electric Elevator and Elevator Problems" before the New York Section of the American Society of Mechanical Engineers on April 13. The one-to-one and the two-to-one gearless traction elevator, he stated, is the type of elevator best adapted for high-speed service in high buildings. The elevator motor, which is preferably placed over the archway, generally consists of a six-pole direct-current machine of the shunt-field type, running at a speed of about 62 r.p.m. for a car speed of about 600 ft. per minute. No gearing is employed. The friction between the cables and a sheave directly connected to the motor's armature spider is relied upon for traction. Despite the low speed of these motors, a typical curve of a 38-hp, 115-volt, 58 r.p.m. motor shows a maximum efficiency of 91.5 per cent, an efficiency of 88.9 per cent at full load, 91.5 per cent at half load and 84 per cent at quarter load. A car speed of about 700 ft. per minute is the maximum elevator speed employed at the present time.

The brake shoes acting on the brake drum are lined with fabricated asbestos instead of leather. The advantages of asbestos for this purpose are that its coefficient of friction is very nearly constant at low temperatures and that it does not vary appreciably up to 460 deg. Fahr. Moreover, the coefficient of friction does not vary with the speed, and no creeping action of the elevator car in stopping due to a lower coefficient of friction at low speed is noticeable. Ball bearings the speaker considers to be superior to roller bearings for elevator service in that a ball bearing can run partially out of alignment without excessive construction strains or friction, while a roller bearing cannot. The ball bearing also has the property of resisting a certain amount of end thrust, thus eliminating the need for an end-thrust device necessary with roller bearings.

In the Equitable Life Building in New York City some of the elevators are run as "expresses" at 650 ft. per minute between certain floors and as "locals" at 550 ft. per minute between other floors. The change in car speed is automatically obtained by a device which can effect the change at any floor desired. The traction principle can also be applied to high-speed motors where reduction gearing is employed. However, with either worm or herringbone gearing about 1.5 hp is lost owing to the churning of the oil in the gearing at a car speed of about 600 ft. per minute. When used with geared traction elevators the high-speed motor is practically as efficient as the low-speed motor used with gearless types at full load, but not so at part load.

The author described a method of determining the kinetic energy of a complete elevator installation by a summation of the kinetic energies of the numerous moving parts reduced to kinetic energies at the same

speed. He then pointed out that a helical-geared traction elevator with a motor running at 505 r.p.m. and with a car speed of 600 ft. per minute represents a kinetic energy of 13,400 ft.-lb., while in the case of the same car speed with a one-to-one gearless traction elevator operating at 62 r.p.m. a value of 2450 ft.-lb. is of 71 per cent was stated as the maximum efficiency of a complete elevator installation of the gearless traction type in New York City.

The author closed his paper with a discussion of a new type of safety device. The force which must be exerted to stop a falling car is often as high as 12,000 lb. It is hence best that the safety device be arranged to apply a strong force in the case of a falling car and a lesser force in case the ropes are intact. This is necessary to prevent shock. In the device described, when the car speed becomes excessive, a governor operates a circuit interrupter causing a magnet to release a spring-operated safety device, pressing the safety shoes against the running rails. In the case of a falling car the safety rope causes a sheave to be rotated which operates right-hand and left-hand screws, forcing the safety brake shoes against the rails and thus exerting the maximum braking force. The paper contained considerable data on the construction of elevator motors and elevator parts as well as a discussion of various auxiliary devices.

In discussing the paper Mr. Charles R. Pratt made a very interesting suggestion in the case of replacing high-speed plunger-type hydraulic elevators with high-speed electric elevators. He pointed out that the counterweight in a modern elevator installation represents nearly one-half of the inertia of the moving parts. Taking this as a basis, he believed it would be economical to equip a high-speed plunger-type hydraulic elevator with an electric motor for the purpose of producing an upward movement of the car, no counterweight being employed. He suggested that the plunger arrangement be retained for the downward movement of the car, the car being allowed to descend by gravity under hydraulic control. The motor would be so arranged as to pump back energy to the line during the descent of the elevator. In this way, he maintained, a surprising efficiency can be obtained.

Wire and Cable Manufacturers Meet

A wire and cable section of the newly organized Associated Manufacturers of Electrical Supplies was formed at a meeting held at the Hotel Biltmore, New York, on Wednesday of the present week. Mr. LeRoy Clark, Safety Insulated Wire & Cable Company, New York, acted as chairman of the organization meeting. Mr. W. F. Field, Phillips Insulated Wire Company, was temporary secretary. Mr. Robert K. Sheppard, president of the Associated Manufacturers of Electrical Supplies, was present and set forth the relations of the proposed section to the central organization.

After preliminary discussions Mr. Sheppard read the article of the by-laws of the main organization dealing with sections. Tentative by-laws for a section were then read by Mr. Field, and after some consideration and slight changes were adopted. They will be submitted to the board of governors of the main association for formal approval.

The following officers of the section were elected: Secretary, Mr. Wallace S. Clark, General Electric Company; treasurer, Mr. Edward Sawyer, Atlantic Insulated Wire & Cable Company; executive committee, Messrs. F. J. Newberry of the John A. Roebling's Sons Company, Everett Morss of the Simplex Wire & Cable Company, W. F. Field of the Phillips Insulated Wire Company, H. D. Cheever of the Okonite Company, and R. E. Lucas of the Marion Insulated Wire & Rubber Company. The chairman will be named by the board of governors of the main association.

The meeting was attended by the following: Messrs. G. B. North and J. C. Bridgman, Hazard Manufacturing Company; G. A. Cragin, American Steel & Wire Company; H. D. Cheever, Okonite Company; H. A. Hammond, Rome Wire Company; G. B. Hunter, Detroit Insulated Wire Company; Mr. Hammond, American Electrical Works; R. S. Satterlee and F. J. Hall, Habirshaw Wire Company; R. W. Seiberling, Indiana Rubber & Insulated Company; F. J. Newberry and Mr. Bellis, John A. Roebling's Sons Company; W. A. Conner, Standard Underground Cable Company; Edward Sawyer and Mr. Johnson, Atlantic Insulated Wire & Cable Company; C. H. Bowen, Collyer Insulated Wire Company; R. K. Sheppard, B. F. Goodrich Company; J. H. Mason, Simplex Wire & Cable Company; R. E. Lucas, Marion Insulated Wire & Rubber Company; William C. Hall, A. A. Wire Company; L. O. Brewster, New York Insulated Wire Company; W. H. Barney and S. R. Schwartz, Bourn Rubber Company; LeRoy Clark, Safety Insulated Wire & Cable Company; W. F. Field, Phillips Insulated Wire Company; E. W. Moore and J. Nelson Shreve, Electric Cable Company.

Southern Idaho Power Merger to Be Investigated

The Public Utilities Commission of Idaho has announced that it will investigate the reported hydroelectric merger of southern Idaho. Negotiations are now in progress between the commission and the Attorney-General's department to bring about a preliminary hearing, to be held on or about April 20 in Boise, and representatives of the companies will be asked to appear.

New Rates of New York Edison Company

The new schedule of rates of the New York Edison Company, filed with the New York Public Service Commission, First District, on April 15 and effective on May 1, follows:

General.—First 900 kw-hr. monthly, 8 cents per kw-hr.; next 100 kw-hr. monthly, 7 cents per kw-hr.; next 200 kw-hr. monthly, 6 cents per kw-hr.; next 300 kw-hr. monthly, 5 cents per kw-hr.; next 400 kw-hr. monthly, 4.5 cents per kw-hr.; excess over 1900 kw-hr. monthly, 4.25 cents per kw-hr.

Motor Service.—First 450 kw-hr. monthly, 8 cents per kw-hr.; next 100 kw-hr. monthly, 7 cents per kw-hr.; next 1350 kw-hr. monthly, 6 cents per kw-hr.; excess over 1900 kw-hr. monthly, 4.25 cents per kw-hr.

Wholesale.—First 75,000 kw-hr. yearly, 5 cents per kw-hr.; next 100,000 kw-hr. yearly, 4 cents per kw-hr.; next 150,000 kw-hr. yearly, 3 cents per kw-hr.; next 775,000 kw-hr. yearly, 2.5 cents per kw-hr.; excess over 1,100,000 kw-hr. yearly, 2 cents per kw-hr.; yearly minimum guarantee, 75,000 kw-hr.

Break-Down Service.—Minimum guarantee, $24 yearly per kilowatt of maximum demand.

Meter Service.—Except as may be deemed necessary for purposes of efficient metering, only one meter per service and per contract will be installed.

The above rates do not in any case include first installation or renewal of incandescent lamps or the care of arc lamps. "Free renewal" incandescent lamps will, if desired, be provided at 0.5 cent per kw-hr., or they will be sold to customers at cost.

Miscellaneous News Notes

Artesian Well Runs Electric Plant.—An enterprising ranchman at Bismarck, N. D., having on his ranch an artesian well delivering water at a pressure of 70 lb. per sq. in., is utilizing the water therefrom to run an electric plant to supply energy for his own purposes.

Ohio Utilities to Secure Municipal Franchises Only on Authority of Commission.—On April 7 the public utilities committee of the House of Representatives of Ohio reported favorably on the Sprague bill, which provides that no rival electric-light, artificial or natural gas, water-works or heating or cooling company may secure a municipal franchise until it obtains from the Public Utilities Commission a certificate of public necessity.

Resignations Requested from Ohio Commissioners.—Governor Frank B. Willis has requested the resignation of fourteen members of state commissions, among them being Messrs. Charles C. Marshall and Oliver H. Hughes of the Public Utilities Commission. These men are all appointees of former Governor Cox. Several of those requested to resign have taken the position that the Governor cannot force the resignations on a purely political basis.

Bill to Examine Superintendents of Municipal Utilities.—Senator J. A. Moore has introduced in the Ohio Legislature a bill which provides for a board of examiners of superintendents of municipal utilities to consist of three members to be appointed by the Governor. Their duty will be to examine all applicants for positions of superintendents of municipal utilities. The board is to have power to revoke licenses for incompetency or for anything making the holder unfit for his position.

Dayton Company Makes Prize Offer.—To stimulate further interest among employees in the company's business and in its operation the Dayton (Ohio) Power & Light Company has offered to pay to employees $5 each month for the best adopted suggestion and 50 cents apiece for all other adopted suggestions. Boxes have been installed in the company's offices and plants to receive communications. Suggestions may relate to any branch of the company's business or practice.

Municipal Employees Must Pay for Back Service.—Although the City Council of Cashmere, Cal., in March, 1911, voted free water and electricity to the city officials, those who have taken advantage of the act must now reimburse the municipality to the amount of approximately $600. An investigation showed that the Council had no right to grant such service. Inasmuch as no meters are used in Cashmere, only the minimum charge of $1 a month will be made for the back service.

Commission to Decide Rates for Municipal Service.—The question of determining light rates for the city of Princeton, Ind., will be placed before the Indiana Public Commission. Final action on the question by city authorities was taken when the time given the Princeton Light & Power Company to accept the city's lighting rates proposition expired. The city and the lighting company have been making proposals to each other for several months, but have been unable to agree on the terms of a franchise.

Utilities in Kansas City Politics.—Mayor C. W. Green, of Kansas City, Kan., has been re-elected on a platform including demands for strict enforcement of franchise obligations by utilities, especially demanding that the Metropolitan Street Railway Company must meet certain requirements before he will support any steps toward a franchise. Mr. L. H. Chapman, who is largely responsible for the development of the municipal electric plant, was returned as commissioner of water and lighting service.

Panama Concession Extended.—The concession of R. W. Hebard & Company of the city of Panama for erecting poles throughout that city for an electric distributing system has been again extended. Under the concession the firm was granted the right to transfer the concession, with the consent of the Panama government, to others. The Panama-American Corporation, which has been in existence since 1903, has a contract to furnish the city with electrical energy until 1923. It is thought that the new electric plant will be built to furnish energy for the Panama Tramways Company, which is at present purchasing energy from the Isthmian Canal Commission, although its contract with the commission has expired.

Electrical "Town Clock" for Chicago.—An addition consisting of a flashing clock sign and an inscription in 12-ft. letters reading "Ye Town Clock" has been installed to operate in connection with the large motograph sign of the Commonwealth Edison Company, Chicago (see the ELECTRICAL WORLD, Oct. 17, 1914). The words "Ye Town Clock" and the original message, "America's Leaders," flash alternately at the top of the sign, and the number faces of the clock sign are operated so that the time is flashed on the motograph face during the intervals between the motograph phrases which were formerly left blank. This sign is said to be the largest motograph sign in the world. Its message can be read at a distance of 2 miles.

Bonds for Construction of Ohio Municipal Plants.—The Behne bill, altered somewhat by amendments, was passed by the Ohio Senate on April 7 and sent to the House of Representatives for concurrence. It now provides that bonds issued at the instance of a municipal council for the purpose of acquiring or constructing a public utility plant shall be a lien on the property only. If the faith and credit of the municipality is pledged for the bonds, the question must be submitted to a vote of the electors and at least two-thirds must be favorable. In the case of new plants the bill shall not be operative for the first three years so far as setting aside of a portion of the income to redeem bonds and pay interest is concerned, but after that time it is to be fully operative.

New York Franchise Tax Upheld.—The United States Supreme Court, in a decision rendered on April 11, held that the Interborough Rapid Transit Company of New York must pay a franchise tax imposed by New York State for the privilege of doing business. The case was in the United States Supreme Court on appeal from the New York Court of Appeals. Justice Holmes, who rendered the opinion, held that there is no error in the decision of the Court of Appeals and that the company is liable for the tax on earnings from operation of the subway, which it acquired by lease from Mr. John B. McDonald, and that the clause providing for exemption of taxes in the contract between New York City and Mr. McDonald did not relieve the Interborough company of the tax imposed on it as a corporation for doing business.

Examination for Electrical Expert Aid (Ship).—A competitive examination will be held by the United States Civil Service Commission on May 12 for a vacancy in the department of construction and repair, Navy Yard, Washington, D. C., at a salary of $4 a day. The duties of this position require a theoretical knowledge of all kinds of electrical apparatus used on board naval vessels, capability of preparing specifications and requisitions for electrical material for ships undergoing construction and repairs, making of tests of electrical auxiliaries in use on shipboard, and estimating the time, material and cost of making repairs of electrical equipment on board ship. Applicants must have had at least three years' practical experience in electrical work and must be twenty-three years of age or more. Persons desiring to take this examination should send for Form 1312, stating title of examination, to the United States Civil Service Commission, Washington, D. C.

Pan-American Financial and Trade Conference.—All countries in the new world have indicated unofficially their desire to accept the invitation of the United States to take part in the Pan-American financial conference to be held in Washington on May 10. Formal acceptances have been received from Chile, Argentina, Uruguay, Peru, Salvador, Ecuador, Honduras and Nicaragua. Mr. Samuel Hale Pearson, of Buenos Aires, a prominent banker and business man, will head the delegation from that country. The capital of the banks and business corporations with which Mr. Pearson is connected or in which he is serving as a director is said to aggregate $700,000,000. A former president of Salvador, now vice-president, Mr. Alfonso Iquinones, will be the ranking delegate from that country. President Wilson and all members of the Cabinet, as well as the members of the Federal Reserve Board, will attend the meetings at one time or another. According to present plans the sessions will be held in the building of the Pan-American Union in Washington.

Associations and Societies

Joint Illumination Meeting.—The joint meeting of the New York Section of the Illuminating Engineering Society with the National Electric Light Association and the National Commercial Gas Association which was to have been held on April 7 has been postponed to April 19. A program of the meeting was printed on page 884 of the ELECTRICAL WORLD dated April 3.

A. I. E. E. Meetings.—Upon the recommendation of the meetings and papers committee authority has been granted by the board of directors of the American Institute of Electrical Engineers to hold an Institute meeting at Philadelphia, Pa., on Oct. 11, 1915, under the auspices of the Philadelphia Section, and also an Institute meeting at St. Louis, Mo., under the auspices of the St. Louis Section.

Electric Club of Chicago.—A combined lecture and moving-picture show was given by Mr. J. E. Latta of the Underwriters' Laboratories before the Chicago Electric Club April 15. The speaker's subject was "Safety Engineering." The moving pictures, now exhibited for the first time, show in actual performance numerous engineering tests and investigations carried on in the Underwriters' Laboratories in the interest of safety.

Brooklyn Polytechnic Electrical Society.—A lecture on "Lighting by Modern Incandescent Lamps with Special Reference to Color" will be delivered before the Electrical Engineering Society of the Polytechnic Institute of Brooklyn, N. Y., by Dr. Clayton H. Sharp, of the Electrical Testing Laboratories, New York, at 8.30 p.m. on Friday, April 23. The lecture, which will be held in the institute chapel, No. 99 Livingston Street, Brooklyn, will be followed by an informal dance in the gymnasium.

Western Society of Engineers.—Papers presented before the Western Society of Engineers at Chicago, Ill., April 12, by Messrs. W. L. Smith and W. W. Priest and by Mr. Andrews Allen of Chicago described respectively an electrically operated lift bridge on the lines of the Pennsylvania Railroad over the Chicago River and a combined steam and electrically operated coal mine at Bicknell, Ind. This mine, which is owned by the American Coal Mining Company, is said to be the only mine in the Indiana-Illinois coal field at which an isolated alternating-current power plant is operated. Mr. W. L. Emmet, of the General Electric Company, Schenectady, will read a paper on "Electric Ship Propulsion" before the society on April 26. Turbo-generators now operating on the United States Collier *Jupiter* and other government vessels were designed under the direction of Mr. Emmet.

Program of Iowa Section, National Electric Light Association.—The program for the fifteenth annual convention of the Iowa State Section of the National Electric Light Association, which is to be held at Keokuk April 20, 21 and 22, has been arranged as follows: Address of welcome, by Dr. S. W. Moorehead, Mayor of Keokuk; address of president, by Mr. Rufus E. Lee; "Gas-Filled Tungsten Street-Lighting Lamps and Fixtures," by Messrs. E. M. Walker of Dubuque and T. Crawford of Clinton; "Gas-Filled Tungsten Lamps," by Mr. H. Schroeder, Harrison, N. J.; "Workmen's Compensation Insurance as It Affects Public Utilities," by Messrs. A. L. Dodd of Charles City, Austin Burt of Waterloo and Thomas Crawford of Clinton; "Possibilities of Business from Rural Transmission Lines," by Messrs. W. H. Burtis of Decorah, F. S. Payne of Centerville and H. W. Garner of Des Moines; "Basic Principles of Rate-Making for Central Stations," by Mr. F. A. Warfield of Peoria, Ill.; "Controlled Flat Rates," by Mr. E. T. Hughes of Dubuque; "Power Development Methods for Iowa Central Stations," by Mr. Edward Soukup of Cedar Rapids; "Maximum-Demand Meters," by Mr. J. V. Montgomery of Keokuk; "The Financial Side of Electric Power Transmission," by Prof. Arthur H. Ford of Iowa City; "Revised Facts and Factors" report, by Messrs. Austin Burt of Waterloo and H. W. Wagner of Ames; "Outdoor Substation Construction," by Mr. Herbert W. Young of Chicago; "The Diesel Engine in Central-Station Service," by Mr. E. B. Pollister of Minneapolis, and "Safety First," a paper prepared by the National Electric Light Association. Among the entertainment features on the program are automobile trips, boat trips and theater parties for the ladies.

Public Service Commission News

Missouri Commission

The valuation of the physical property of the Kansas City Electric Light Company under the direction of the Missouri commission has been completed. Statistics have also been compiled from the accounts of the company. A date will be fixed soon for a hearing in the case.

Washington Commission

An amendment to the law has been adopted providing that proposed utilities, both municipal and private, must obtain certificates of public convenience and necessity from the commission before the commencement of business. This certificate may be granted only after public hearings.

New York Commissions

The Public Service Commission for the First District has directed its secretary to notify all public service corporations that failure upon their part to respond promptly to letters from the secretary in regard to informal complaints will be deemed sufficient reason for the institution of formal proceedings requiring the attendance of the officers of the companies at the commission's offices.

The First District commission has directed the Edison Electric Illuminating Company of Brooklyn to file on or before May 8 data for April showing for each customer the rate, class, amount of energy and amount of bill for the month; also the number of meters and the maximum demand. Engineers of the commission have completed an appraisal of the property.

Idaho Commission

The Beaver River Power & Light Company has been denied the right to enter the Pocatello (Idaho) field in competition with the Southern Idaho Water Power Company, which now controls it. In ruling that the alleged convenience and necessity are not apparent the commission said in part: "With all the surplus water-power we have in southern Idaho that can be secured without cost, except the cost of harnessing it up, it does seem somewhat incredible that crude oil can be purchased in Wyoming, California or New Mexico, then transported to Pocatello, Idaho, by rail or otherwise, and there converted into electrical energy at a less cost of production per kilowatt-hour than the cost of hydroelectric energy per kilowatt-hour. The evidence in this case falls far short of proving any such state of facts. It is therefore ordered that the application be denied."

Illinois Commission

At the hearing of the complaint of Mr. J. B. Hogarth against the Chicago Elevated Railways Collateral Trust on April 1, Commissioner Owen P. Thompson ordered an investigation into the books and records of the trustees to discover any evidence which might show that the trustees in fact carry on the operation of the Chicago Elevated Railways. Mr. Gilbert E. Porter, attorney for the trustees, opposed publicity of the books, which he declared would show no other relation than that the trustees hold about 98 per cent of the stock of the railways, together with bonds and notes of the railway companies. This relation, declared Mr. Porter, does not constitute the trustees a utility, and he cited the trust agreement for definition of the powers of the trustees. Commissioner Thompson said that the fact that the trustees deal only with securities of the elevated railways and that the organization of the trustees' business had been based on the credit of the elevated companies was sufficient to show the commission that the trustees have a close and intimate business relationship with the elevated companies which, it might develop, would bring them within the purview of the statute as a public utility. Mr. Porter consented to open the books to the commission accountant.

In the case of Mr. J. B. Hogarth of Chicago versus the Commonwealth Edison Company, the plaintiff sought to show that the company had paid average dividends amounting to 33.9 per cent per annum for the last seven years. During that period it was stated by Mr. Seymour Stedman, attorney for Mr. Hogarth, $16,000,000 in cash and $12,695,000 in stock dividends have been paid. Payment of these sums, it was alleged, indicated that the rates were unreasonable. Mr. G. E. Porter, attorney for the company,

denied the allegations and argued that the rate of return upon the valuation of the company's plant, and not its dividend rates, were, according to court and commission rulings, the correct basis for judging the fairness of rates. He stated that during the past fifteen years the company's rate of return on its investment had not exceeded 7 per cent per annum. Mr. Porter also cited the fact that a committee, of which Mr. Ray Palmer, city electrician, was chairman, appointed by the City Council committee on oil, gas and electricity, had made an investigation covering a period of eighteen months and had recommended a schedule of rates to the Council committee. Upon this recommendation the Council, he said, had passed a five-year ordinance in 1913 establishing a reduced rate schedule under which the company is operating. It would seem inadvisable therefore, continued Mr. Porter, in view of the recent and thorough investigation to institute another rate investigation unless proof of error in the Council report or general dissatisfaction with existing rates could be shown. The commission ruled that the burden of proof lay with the plaintiff in view of the recent Council action, and that although the commission under the law had a right to institute another investigation such action seemed inadvisable. Another hearing was granted to the plaintiff, however, to be held on May 24.

The balance sheets on which the commission authorized the issuance of $10,921,000 of first-mortgage 5 per cent gold bonds of the Commonwealth Edison Company, Chicago, are to be re-audited by the commission to ascertain whether or not they are correct. The re-auditing was ordered April 13 after a hearing on a complaint filed by Mr. J. B. Hogarth in which it was alleged that the statements in the balance sheets were incorrect.

Maryland Commission

According to an opinion rendered by the chief counsel of the commission, gas and electric utilities in Maryland cannot distribute stock dividends unless the amount of cash represented by the issue of such stock has been actually put into the property. The opinion was rendered on application by gas and electric companies for permission to capitalize earnings expended for capital account prior to April 1, 1914. The counsel holds that, under the new law, gas and electric light companies cannot pay dividends in stocks equal to more than the amounts which would have actually been disbursed in cash. It was held further that any appreciation or depreciation at the time application to capitalize is made should be taken into consideration. The counsel says: "If, for any reason, the property of the corporation has not been enhanced in value by the expenditure of the earnings to the extent of the par value of the stock proposed to be distributed as a dividend, the issuance of such stock dividend would be irregular and improper. Every dollar of stock issued as a dividend by a corporation should be represented at the time of its issuance by a dollar's worth of property added to the corporate assets."

Indiana Commission

The commission has allowed the Farmers' Mutual Telephone Company, which is being organized near Boswell, Ind., to continue to sell its stock and bonds, although permission to enter the town in competition with the Boswell Telephone Company, which has surrendered its franchise to the commission, has been refused. Attention has been attracted to the case because of the precedents it has established in telephone regulation. When the 1915 Legislature met it was hoped that the Indiana law would be amended in some fashion to prevent small farmers' exchanges from compelling physical connection with the larger exchanges of city and town telephone companies. There was so much fear, however, that enemies of the law would attempt to cut down its effectiveness were it ever opened up for amendment that the proposed amendment was not attempted. Therefore, although it is known that some members of the commission were against the scheme, the farmers who are organizing the mutual company near Boswell were authorized to go forward with the sale of their securities, though they were denied a second franchise in the town of Boswell. The officers of the farmers' company say they will first ask the Boswell Telephone Company to give them physical connection or they will petition the commission for an order.

Personal

Mr. E. A. Wilcox has resigned as commercial agent of the Great Shoshone & Twin Falls Water Power Company, Twin Falls, Idaho, to accept a position in the commercial department of the Great Western Power Company at San Francisco.

Mr. T. W. McNamee has resigned as manager of the Wabash (Ind.) Water & Light Company, a position he has held for the past fifteen years, to take up active duties as secretary-treasurer of the Ford Meter Box Company, Wabash, Ind. Prior to the organization of the Wabash Water & Light Company Mr. McNamee was manager of the Wabash Electric Light Company. He still retains his position as president of the lighting company, but will have no further part in its active management.

Mr. George W. Hill has joined the staff of the Society for Electrical Development, Inc. He will devote his time to the work of the field co-operative section under Mr. George B. Muldaur. Mr. Hill is a graduate electrical engineer of Tufts College and has been in the electrical field continuously since his graduation. He spent three years in the employ of the Boston Elevated Railway, six years in the storage-battery sales and engineering work including two and a half years in charge of the Canadian territory of the Canadian General Electric Company, and five years with the Westinghouse interests, part of which time he was in charge of the detail supply department at Boston and the remainder with the Westinghouse Lamp Company.

Mr. Joseph A. Kucera, formerly business manager of the ELECTRICAL WORLD and more recently business manager of the *Electric Railway Journal*, has resigned from the latter position. Mr. Kucera has had general charge of the business department of the WORLD or of the *Journal* since 1908, and his versatility and business ability are shown by the fact that for some time he was business manager of both papers. Previously to 1908 Mr. Kucera was business manager of the *Electric Railway Review* of Chicago, which was purchased by the McGraw Publishing Company in that year. He originally studied law and is a member of the Chicago bar. Mr. Kucera has not yet announced his plans for the future, but has the best wishes of his former associates in anything he may undertake.

Obituary

Alex M. Worthington, formerly general manager of the Louisville (Ky.) Lighting Company, is dead. Mr. Worthington was born in St. Louis fifty-eight years ago, removed to Covington, Ky., as a youth and became connected with the electric-lighting business. He went to Louisville twenty years ago to enter the service of the Louisville Lighting Company, with which company he remained until he retired three years ago on account of ill health. A widow, a daughter and two sisters survive him.

W. A. Foote, president and general manager of the Commonwealth Power Company of Jackson, Mich., died at his home in Jackson, April 14, at the age of sixty-five. With his brother, Mr. J. B. Foote, Mr. W. A. Foote established the electric-lighting plant at Jackson many years ago, and subsequently organized the extensive interconnected transmission system which now links the towns and cities of central Michigan. Among the achievements of the Foote interests have been the construction successively of the first 72,000-volt transmission line, the first 100,000-volt line and the first 140,000-volt line.

Maurice A. Viele, president of the consulting engineering firm of Viele, Blackwell & Buck, New York, died April 10. Mr. Viele was born at Geneva, N. Y., and was well known in engineering circles. He was a veteran of the Spanish-American War and went to the front as adjutant of the corps of engineers that was recruited and sent by the General Electric Company. Mr. Viele was associated with that company for many years and at the age of twenty-eight was assistant to the chief engineer. He was a graduate of Hobart College and the Massachusetts Institute of Technology. Mr. Viele was forty-nine years old at the time of his death. He was a member of the St. Nicholas and Engineers' Clubs and of the Holland Society, New York.

Corporate and Financial

American Water Works & Electric Company, New York, N. Y.—The company has sent to holders of collateral trust notes of the United Water & Light Company word that the plan for the exchange of the notes for bonds of the American Water Works & Electric Company, Inc., is operative, more than 70 per cent of the notes having been deposited. Those who have not deposited their notes will be given the privilege of doing so for a limited period.

British Westinghouse Electric Manufacturing Company, Ltd., London, England.—Notwithstanding the war, the accounts, according to the annual report for the year ended Dec. 31, 1914, show continued improvement. The results of operations were:

Gross profit	£267,819
Interest	69,654
Expenses on surplus land and buildings	2,822
Depreciation	43,716
Balance	£151,627
Dividends	75,000
General reserves	50,000
Written off patents, etc.	25,000
Balance	£1,627
Balance from 1913	6,494
Balance brought forward	£8,121

Commonwealth Edison Company, Chicago, Ill.—Announcement is made by the company of the sale of $8,000,000 of first mortgage 5 per cent bonds. Approximately $6,900,000 of the bonds were sold to reimburse the treasury for net income used in making capital expenditures, the remainder, $1,100,000, being to provide funds for extensions and additions during 1915. The company has retired $7,000,000 notes.

Diamond Light Company, Cincinnati, Ohio.—The company has been authorized by the Public Utilities Commission of Ohio to issue $30,000 common stock to subscribers who have paid therefor. The proceeds have been expended for the purchase of material and the installation of plant.

Edison Electric Illuminating Company of Boston, Mass.—Having been granted authority by the Massachusetts Board of Gas and Electric Light Commissioners, the company is offering pro rata to stockholders of record April 1, 1915, 20,480 shares of its capital stock at $215 per share. The right to subscribe expires April 23, 1915. After the sale of this stock the company will have a capital stock of $22,528,000 par value.

Electric Properties Corporation and Westinghouse, Church, Kerr & Company, New York, N. Y.—The annual report of these companies for the year ended Dec. 31, 1914, shows the following consolidated earnings account:

Income from operations, interest, dividends, commissions, miscellaneous, etc.	$665,368
Operating expenses of Westinghouse, Church, Kerr & Company, administrative and general expenses	363,594
Total	$301,774
Bond interest	24,000
Balance	$277,774
Surplus at Jan. 1, 1914	57,463
Total	$335,237
Dividends paid on preferred stock of Electric Properties Corporation from Nov. 30, 1913, to Sept. 30, 1914	196,010
Balance	$139,227
Depreciation of securities and accounts held at Sept. 1, 1913, or acquired since in accordance with contracts made prior to that date	69,073
Balance carried to balance sheet	$70,154

Electric Storage Battery Company, Philadelphia, Pa.—The annual statement for the year ended Dec. 31, 1914, of the company shows the following earnings:

Gross sales, less cost of manufacture and purchase and all expenses incident thereto		$1,395,793
Operating expenses		547,165
Net earnings from sales		$848,628
Other income		254,610
Total net income		$1,103,238
Dividends paid during year		649,964
Net surplus, 1914		$453,274
Surplus accrued to Dec. 31, 1913	$3,312,523	
Less sundry adjustments of accounts and all items not incident to the current year	75,729	
		3,236,794
Total surplus		$3,690,068

Fort Worth (Tex.) Power & Light Company.—The number of electric customers of the company, according to the annual report for the year ended Dec. 31, 1914, was 9474 in 1913 and 10,291 in 1914. The output has increased from 29,477,600 kw-hr. in 1913 to 61,348,000 kw-hr. in 1914, or 108 per cent. The statement follows:

	1914	1913
Gross earnings	$898,090	$671,000
Operating expenses and taxes	414,248	273,579
Net earnings	$483,842	$397,421
Interest charges	106,728	82,788
Net income after charges	$377,114	$314,633
Dividends on preferred stock	66,733	49,020
Balance	$310,381	$265,613

Greenville (Ohio) Electric Light & Power Company.—The Ohio Public Service Commission has authorized the company to issue at not less than par $8,000 par value of its common capital stock for the erection of a transmission system to connect with the lines of the Brookville & Lewisburg Lighting Company.

Hanford Irrigation & Power Company, Portland, Ore.—The company's assets, of an estimated value of over $1,000,000, were sold recently by Receiver E. F. Benson to Mr. Henry K. T. Lyons, of Denver, Col., for $386,000.

Holton Power Company, Holtville, Cal.—The California Railroad Commission in a supplemental order has granted the company an extension of time to March 24, 1916, within which to issue $200,000 face value of its 6 per cent first and refunding mortgage gold bonds.

Idaho-Oregon Light & Power Company, Boise, Idaho.—Owners of the company's first and refunding mortgage bonds who have deposited their bonds with the Priest protective committee have received from that committee a circular stating that, in accordance with the reorganization plan submitted to the bondholders on Nov. 7, the committee has purchased the property at a foreclosure sale and is now working on the details of the plan. According to the circular, it has been generally understood by those familiar with the conditions existing in the territory served by the Idaho-Oregon company that the ultimate solution of the problem would be found in the joint operations of the various electric properties in that region. Since the committee came into control of the property it has been able to complete arrangements for joining in a consolidation upon terms which it believes to be advantageous to the depositors. The National Securities Corporation has been organized for the purpose of acquiring properties in southern Idaho and adjacent territory which may be advantageously operated together, and it has acquired the interests of the Idaho Railway, Light & Power Company and the Idaho Power & Light Company and is in the process of acquiring other properties. Since the purchase of the Idaho-Oregon property by the committee it has procured from the National Securities Corporation a proposal to purchase the bonds deposited with the committee, paying therefor in securities of the National Securities Corporation, and the committee has entered into an agreement with respect thereto covering the details of the proposed purchase, subject to the assent of the depositing bondholders. The following plan is therefore submitted by the committee for the disposal of the first mortgage bonds of the Idaho-Oregon Light & Power Company deposited with the committee: Holders of Idaho-Oregon bonds of the par value of $1,000 will receive in exchange the following securities from the National Securities Corporation: $450 par value in thirty-year 6 per cent gold debenture bonds, $450 par value in thirty-year 6 per cent income bonds, and $400 par value in common stock or voting-trust certificates. No preferred stock is to be issued now; when issued, it will be used for the conversion of the debentures and incomes, or for cash, or for the equivalent thereof in property. The debentures are the senior securities of the company excepting that, for temporary purposes, it has authorized the issue of ten-year 6 per cent collateral-trust notes which it is contemplated will be ultimately retired with the proceeds from the securities of the underlying companies. The ten-year collateral notes have been subscribed for at 90 with a bonus of common stock, and the right is granted to all depositors assenting to this plan to participate in this sub-

scription at the same price as the original subscribers, pro rata. The total expense of the committee to date less credits applicable thereto is $90,484, to be distributed upon 1869 bonds now on deposit with the committee, thus making somewhat over $48 per bond which must be paid by a dissenting bondholder upon making his withdrawal.

Illinois Northern Utilities Company, Dixon, Ill.—The annual report for the year ended Dec. 31, 1914, shows:

Electricity, gas, railway and other utilities	$746,894	
Merchandise and miscellaneous income	139,988	
		$886,882
Expenses:		
Electricity, gas, railway and other utilities	$437,510	
Cost merchandise and miscellaneous income	110,065	
		547,575
Earnings for year		$339,307
Interest on bonds	$146,170	
General interest	29,984	
		176,154
Net profits		$163,153
Preferred stock dividends		108,480
Balance		$54,673

Interstate Railway Company, Camden, N. J.—It has been announced that a sufficient percentage of preferred stock has been received to make the company's permanent financing plan operative, and a meeting will be held April 23 to amend the charter in accordance with the preferred-stock plan. An abstract of the plan was given in the ELECTRICAL WORLD of Feb. 6.

Mississippi River Power Company, Keokuk, Ia.—In the annual report of the company, which is operated by the Stone & Webster Management Association, it is stated that the earnings are somewhat less than estimated owing to the fact that some customers experienced unexpected delays in the installation of their electrical equipment, while other customers curtailed their use of energy during the latter months of the year on account of the general unsatisfactory business conditions. The company looks for future increases in income chiefly from the development of business and industries in the cities and towns now served by its lines. It will encourage those who desire to purchase energy for distribution in the country districts and will extend its own lines into new sections when opportunities occur for making contracts on a profitable basis. However, it is stated that no considerable increase in income from new sources is expected until general business conditions show material improvement. For the year 1915 the managers are expecting gross income of approximately $1,700,000. The condensed results of operations for 1914 are as follows:

Income		$1,576,469
Total operating expenses and taxes		321,947
Net income		$1,254,522
Interest charges	$1,183,263	
Amortization of debt discount and expenses	10.800	
Less portion of above interest charges properly chargeable to capital account, being interest on amount expended in preparing for future development	151,125	
Total		1,042,938
Balance		$211,584
Net direct charges to reserve and surplus		6,769
Balance		$204,815
Prior surplus		284,387
Current surplus		$489,202

Ontario Power Company of Niagara Falls, Ontario.—The annual report for the year ended Dec. 31, 1914, states that under the provisions of the railway act of Canada the declaration of dividends should be made by shareholders at the regular annual shareholders' meeting. The payment of dividends during the year 1915 will not therefore be made in quarterly instalments. The proceedings with respect to all dividends heretofore declared and paid by the company were submitted at the annual meeting, Feb. 16, 1915, and payment thereof was confirmed by the shareholders. The energy generated is sold as follows: By contract with the Hydro-Electric Power Commission, through which about seventy-five municipalities in Ontario are now served; (2) by contracts with distributing companies, manufacturers, electro-metallurgical and other industries at Niagara Falls, Ontario, and the territory adjacent to the Welland Canal, and (3) by contract with the Niagara, Lockport & Ontario Power Company, which receives the energy at the international boundary line and distributes it over a wide area as far east as Syracuse and Oswego and south from Lockport to West Seneca, and westerly to Dunkirk, N. Y., and Erie, Pa. The output has grown from 9,133,200 kw-hr. for six months of 1906 to 743,630,000 kw-hr. for the past calendar year. The income and expense account of the company and the Ontario Transmission Company, Ltd., intercompany payments eliminated, for 1914 is printed below:

Sale of energy	$1,719,835	
Less purchased energy	97,586	
		$1,622,249
Government rental		96,678
Gross earnings		$1,525,571
Operating expenses		232,534
Net earnings		$1,293,037
Other receipts		105,485
Total net income		$1,398,522
Interest		898,444
Earnings after paying interest		$500,078

Pacific Power & Light Company, Portland, Ore.—The annual report of the company for the year ended Dec. 31, 1914, shows that the number of electric customers increased from 15,285 in 1913 to 16,572 in 1914. The output in 1914 was 35,863,259 kw-hr. and in 1913 was 32,101,000 kw-hr. Approximately 68 per cent of the gross earnings was derived from sales of electric energy. The statement for 1913 and 1914 follows:

	1914	1913
Gross earnings	$1,376,490	$1,288,059
Operating expenses and taxes	659,835	663,674
Net earnings	$716,655	$624,385
Interest charges	384,439	341,656
Net income after charges	$332,216	$282,729
First preferred dividend	140,000	140,000
Second preferred dividend	105,000	102,500
Balance	$87,216	$40,229

Philadelphia Company, Pittsburgh, Pa.—The company has declared a cash dividend of 1½ per cent. The former quarterly dividends were 1¾ per cent. The two previous quarterly dividends were paid in scrip.

Queensboro Gas & Electric Company, New York, N. Y.—The comparative statement of operations for 1914 and 1913, filed with the New York Public Service Commission, First Division, follows:

	1914	1913
Electrical department:		
Operating revenue	$358,436	$334,853
Operating expenses	223,054	200,283
Taxes	9,213	8,880
Uncollectible bills	411	140
Operating income	$125,758	$125,650
Gas department:		
Operating income	77,894	83,577
Total operating income gas and electric	$203,652	$309,227
Non-operating income	1,012	3,387
Gross income applicable to corporate and leased properties	$204,664	$212,614
Income deductions	131,507	126,107
Net corporate income	$73,157	$86,507
Previous surplus	229,811	162,177
Surplus adjustments—net deduction	6,388	18,873
Surplus at close of year	$296,580	$229,811

Southwestern Power & Light Company, New York, N. Y.—The annual report of the company for the year ended Dec. 31, 1914, shows 38,875 electric customers as compared with 34,672 in 1913. The output increased from 55,849,599 kw-hr. in 1913 to 79,567,158 in 1914, or 42.5 per cent. Approximately 81 per cent of the total income was derived from electric energy sales. Comparative earnings follow:

	1914	1913
Gross earnings of all subsidiaries	$2,799,033	$2,267,091
Balance of subsidiary companies' earnings applicable to Southwestern Power & Light Company	$713,888	$551,081
Expenses of Southwestern Power & Light Company, less other income	54,508	28,005
Balance	$659,380	$523,076
Interest charges on bonds	69,401	7,833
Balance	$589,979	$515,243
All other interest	63,168	79,912
Balance	$526,811	$435,331

Tampa (Fla.) Electric Company.—The annual report of the company for the year ended Dec. 31, 1914, states that it is hardly to be expected that with a continuance of the prevailing depression the principal industries of Tampa, which as yet have been slightly affected, will maintain their normal activity, nor that there will be an increase in earnings in 1915 comparable with that shown in 1914. The company, which is under the management of the Stone & Webster Management Association, showed an increase in net earnings in 1914 of $82,481. The comparative statement for 1913 and 1914 follows:

	1914	1913
Earnings:		
Railway department	$586,927	$501,281
Light and power department	394,073	343,659
Total earnings	$981,000	$844,940
Expenses:		
Operation	$395,811	$352,991
Maintenance	82,781	76,379
Taxes	41,486	37,129
Total expenses and taxes	$520,078	$466,499
Net earnings	$460,922	$378,441
Interest charges	45,470	46,428
Balance sinking fund	9,018	9,320
Dividends paid	252,450	215,045
Direct charges to reserve and surplus	.....	1,411
Prior surplus	363,104	356,867
Replacement reserve	.....	100,000
Current surplus	$517,090	$363,104

Texas Power & Light Company, Dallas, Tex.—The number of electric customers of the company, according to its annual report for the year ended Dec. 31, 1914, increased from 22,033 in 1913 to 24,941 in 1914. The output, which was 21,549,244 kw-hr. in 1913, had increased to 52,931,244 kw-hr. in 1914, or approximately 146 per cent. Approximately 89 per cent of the gross earnings was derived from sales of electric energy. A comparative report follows:

	1914	1913
Gross earnings	$1,605,078	$1,198,762
Expenses and taxes	1,033,388	757,711
Net earnings	$571,690	$441,051
Interest charges	234,297	210,836
Income after charges	$337,393	$230,215
Dividends on preferred stock	112,259	110,250
Dividends on second preferred stock	44,050	.....
Balance	$181,084	$119,965

United Light & Railways Company, Grand Rapids, Mich.—The business, according to the annual report for the year ended Dec. 31, 1914, showed a satisfactory increase in the gas and electric departments, but owing to financial and industrial conditions the railway department showed a slight decrease. Following is the statement for 1914, including inter-company business:

Gross earnings subsidiary companies		$6,166,959
Operating expenses subsidiary companies		3,797,534
Net earnings subsidiary companies		$2,369,425
Interest on subsidiary companies' bonds and notes:		
To United Light & Railways Company	$339,553	
To the public	974,583	
		1,314,136
Net profit to stocks, subsidiary companies		$1,055,289
Net profit due others than United Light & Railways Company		15,506
Earnings available on stocks owned by United Light & Railways Company		$1,039,783
Dividends and interest receivable		344,294
Salaries and miscellaneous earnings		123,155
Gross earnings		$1,507,232
Expenses	$103,835	
Taxes	10,780	
		114,615
Net earnings		$1,392,617
Interest on bonds		333,034
Balance		$1,059,583
Interest on notes	$109,887	
Bond discount	12,912	
		122,799
Balance available for dividends		$936,784
Dividends, first preferred stock		462,801
Balance		$473,983
Dividends second preferred stock		63,272
Balance available for common stock and depreciation		$410,711
Credit to depreciation reserve		165,993
Balance—credit to surplus		$244,718

Manufacturing and Industrial

The Thompson-MacArthur Regulator Company has moved from Buffalo, N. Y., to 121 Canal Street, New York.

The Foxboro Company, Foxboro, Mass., has succeeded the Industrial Instrument Company, manufacturer of recording instruments.

The Commercial Research Company has moved its laboratory, shop and offices from Tuckahoe, N. Y., to Jackson Avenue and Honeywell Street, Long Island City, N. Y.

Ryan & Dippel, formerly associated with the L. K. Comstock Company, have opened an office at 52 Vanderbilt Avenue, New York, as electrical engineers and contractors.

The Reliance Electric & Engineering Company, Cleveland, Ohio, has placed Mr. A. M. MacCutcheon, formerly with the Crocker-Wheeler Company, in charge of its design work.

Walter N. Albertson & Company, public-utility engineers, Milwaukee, Wis., have moved their office from the Railway Exchange Building to larger quarters at 527 First National Bank Building, Milwaukee, Wis.

Denton Engineering & Construction Company.—The Denton Engineering Company, 320 East Fifteenth Street, Kansas City, Mo., has changed its name to the Denton Engineering & Construction Company.

The A. F. Daum Company, Pittsburgh, Pa., manufacturer of fuses, expects to move into a new factory about April 27. The new building will contain double the floor space of the company's present quarters.

The Spray Engineering Company, 93 Federal Street, Boston, Mass, has appointed Mr. L. H. Parker, for the past ten years with the Stone & Webster Engineering Corporation and previously with the General Electric Company, its president.

The Walpole Tire & Rubber Company, Walpole, Mass., has appointed Mr. J. M. Martin, who for the past five years has been Atlanta manager for the Banner Electric division of the National Lamp Works of the General Electric Company, a member of its sales force. Mr. Martin will represent the company in the South.

The Metropolitan Electric Manufacturing Company, Boulevard and Fourteenth Street, Long Island City, has appointed Mr. William Taylor its Western sales agent, with headquarters at the Rookery, Chicago. Mr. Taylor has had offices at 203 Broadway, New York, since 1896, acting as manufacturers' agent and specializing in switches and receptacles.

The Star Mica Mining Company, 61 Broadway, New York, which was incorporated in December, 1914, under the laws of New York State, with a capital of $25,000, is operating the old Sanborn Mine on Tug Mountain, 3 miles from Canaan, N. H. The company purposes to manufacture mica-plate washers and disks and to produce scrap mica for the electrical industry.

The Coil Manufacturing & Repair Company, Cleveland, Ohio, has taken over the electrical department of the Van Dorn & Dutton Company and is making armature, field and induction-motor coils, commutators, etc. The portable-tool department of the company has also been abandoned and the Van Dorn Electric Tool Company has been organized to continue the manufacture of the various tools made by this department. There are common interests in the Van Dorn Electric Tool Company and the Van Dorn & Dutton Company. The latter company is now specializing in the manufacture of gears.

Flashlamp Trade with Belligerents in Deplorable Condition.—A prominent manufacturer of flashlamps declares that on account of unscrupulous and meddlesome agents the export trade of flashlamps to foreign countries at war has suffered very much. There have been a multitude of inquiries, this manufacturer asserts, but the number of flashlamps sold in proportion to the number of inquiries received from abroad is ridiculously small. One cause for this condition is the demand from foreign countries for low-priced goods. If it were not for the various agents whose commissions must be added to the original price of the products, it might be possible for manufacturers of high-grade flashlamps to do a better business.

The Carbo Steel Post Company, Rand-McNally Building, Chicago, Ill., which has recently taken up the manufacture of posts for street lighting and steel poles for telephone and transmission-line work, has just broken ground for a new factory at Cambridge, Ohio. The company also has a plant at Chicago Heights, Ill.

Schweitzer & Conrad, manufacturers of "S & C" fuses and fuse products, have moved from 1774 Wilson Avenue, Chicago, to the Deagon Building, at the corner of Beatrice and Ravenswood Avenues, in the same city. At the new location the company will occupy a larger floor space than it formerly had and will enjoy the conveniences of a fireproof building erected especially for manufacturing concerns.

The McIntosh & Seymour Corporation, Auburn, N. Y., has appointed as its agent Mr. S. A. Hadley, 621 Delaware Street, Kansas City, Mo., who will have charge of the territory comprising Kansas, Nebraska, the southern part of Iowa and the western part of Missouri. Mr. Hadley is interested in the machinery-supply business of the Hadley-Hudson Company of Kansas City. He was also formerly connected with the Griscom-Russell Company and the Atchison, Topeka & Santa Fé Railroad.

Storage-Battery Business Improving.—The United States Light & Heating Company, manufacturer of storage batteries, Niagara Falls, N. Y., reports that the volume of business transacted during the past month is larger than for any similar period during the past year. The company has been in the hands of receivers since July, but a reorganization will be brought about, it is declared, in the near future, and it is thought that the receivership will be abandoned some time in June.

Business in Small Motor-Driven Devices Brisk.—Mr. Geoffrey Shelton, president of the Shelton Electric Company, New York, recently declared to a representative of the ELECTRICAL WORLD that business in electrically operated vibrators, hair driers, drink mixers, dental motors, etc., is very good. Considerable interest is being manifested, he stated, in a new dental motor which is directly connected to the tool. This diminutive motor was described in the ELECTRICAL WORLD of Feb. 27. A demonstration of the little motor was recently given before a large assembly of dentists in Boston.

Good Year for Storage-Battery Company. — The Gould Storage Battery Company, Forty-second Street Building, New York, reports that the past year has been the best it has had. At present the company finds business in battery renewals for electric vehicles very good. The demand for batteries for new vehicles, however, is not so great. Owing to the dullness in railroad affairs, the call for storage batteries for lighting railroad cars is said to be below par. The Gould company has made a considerable number of storage batteries for submarines. Submarines owned by the United States, Russia, Austria-Hungary, Japan and England are equipped with its batteries.

Demand for Heating Appliances in South America.—The Pittsburgh Electric Specialties Company, Pittsburgh, Pa., is receiving a number of orders for appliances such as electric irons, water heaters, toasters, etc., from South American countries. These devices are especially popular, it is declared, in the torrid regions. The company is also shipping many vacuum cleaners to the Argentine Republic. On account of the small usage of carpets in the northern part of the continent, vacuum cleaners are not in such great demand as in the southern part. The Pittsburgh Electric Specialty Company is also sending vacuum cleaners to Europe, a large order having been recently received from England.

Fiber-Conduit Business Normal.—Taken as a whole the business of the Fibre Conduit Company, Orangeburg, N. Y., is reported to be holding its own and is on a par with that of last year. Numerous orders are being received for fiber conduit from central stations, municipalities and railways. For the smaller installations, such as for hospitals, estates, etc., the demand for fiber conduit has not been so great as usual, indicating that the construction of buildings of that type has fallen off. During the past few months the company's business in the South has increased. The Fibre Conduit Company is also shipping considerable quantities of its products to European and South American countries.

Renewed Activity in Building Indicated by Demand for Plate Warmers.—The Prometheus Electric Company, 232 East Forty-third Street, New York, reports that its business in electrically operated food and plate warmers is picking up. These devices are usually installed at the time a house is constructed; the demand for them at this time, therefore, indicates that building operations are progressing. Mr. W. H. Ripley, manager for the Prometheus Company, recently stated to a representative of the ELECTRICAL WORLD that most of the heating appliances manufactured by his company are of special design. Mr. Ripley also asserted that there is a growing demand for low-priced ranges. He thinks that the popularity of the smaller cooking devices is waning.

NEW YORK METAL MARKET PRICES

	April 6 — Selling Prices Bid	Asked	April 13 — Selling Prices Bid	Asked
Copper.	£ s d		£ s d	
London, standard spot	69 17 6		71 17 6	
Prime Lake	16.50		16.62½	
Electrolytic	15.80		16.37½	
Casting	15.50		15.87½	
Copper wire base	17.00		17.37½	
Lead, trust price	4.20		4.20	
Nickel	42.00 to 45.00		42.00 to 45.00	
Sheet zinc, f.o.b. smelter	13.50		13.50	
Spelter	9.75†		10.00†	
Straits tin	47.50†		57.00†	
Aluminum, 98 to 99 per cent.	18.75		18.75	

*OLD METALS

Heavy copper and wire	13.85	14.50
Brass, heavy	9.37½	9.75
Brass, light	8.00	8.62½
Lead, heavy	3.95	3.95
Zinc scrap	7.25	7.25

*COPPER EXPORTS

Total tons to April 13	5,934

*From daily transactions on the New York Metal Exchange.
†Nominal.

New Industrial Companies

The Fox Electrical Corporation, of New York, N. Y., has been incorporated by J. W. Crandall, 165 Broadway, New York, N. Y.; G. Harding and I. W. Bonner. The company is capitalized at $25,000 and proposes to do a general electrical engineering and contracting business.

The Marquette Electric Engineering Company, of Chicago, Ill., has been chartered with a capital stock of $15,000 to manufacture and deal in electrical machinery and supplies. The incorporators are Adolph C. G. Anderson, Edwin A. Fritsch and Hugo Fritsch.

The New York Appliance Corporation, of New York, N. Y., has been chartered with a capital stock of $10,000 to manufacture and deal in electrical and mechanical appliances, motors, dynamos, machinery, etc. The incorporators are S. K. Rasp, D. Herman and S. L. Marcus, 322 East Sixty-second Street, New York, N. Y.

The Globe Multiple Fuse & Electric Globe Manufacturing Company, of New York, N. Y., has been chartered with a capital stock of $25,000 by Louis H. Ferber, 182 Marion Street, Brooklyn, N. Y., and Karvid Enlind, 17 East Thirty-eighth Street, New York, N. Y. The company proposes to manufacture electric fuses, fuse plugs and other electrical devices.

The Dey Electric Corporation, of New York, N. Y., has been incorporated with a capital stock of $20,000 by Harry E. Dey, 303 Arlington Avenue, Jersey City, N. J.; H. W. Hillman and Max E. Schmidt, of New York, N. Y. The company proposes to do a general civil, electrical and mechanical engineering and contracting business, and also to deal in motor vehicles.

The Steam Electric Engineering Company, of Wheeling, W. Va., has been incorporated by F. J. Balleston, H. E. Newman, F. E. Finnegan, E. E. Smith and H. M. Walmsley. The company is capitalized at $25,000 and proposes to do a general electric, gas and steam fitting business, and to sell gas engines and electrical appliances. The company also proposes to generate and distribute electricity for lamps, heaters and motors.

The Charleston Electrical Advertising Company, of Charleston, S. C., has been incorporated with a capital stock of $3,000. The officers are: W. S. Lanneau, president, and W. K. McDowell, secretary and treasurer.

The Bison Electrical Company, of Buffalo, N. Y., has been incorporated with a capital stock of $25,000 to do a general electrical contracting business. The incorporators are F. M. Smith, B. H. Fisher and J. T. Arundell, of Buffalo, N. Y.

The Nonowatt Electric Import Company, of New York, N. Y., has been incorporated with a capital stock of $5,000 by Nathan Schwartzer, 500 West 175th Street, New York, N. Y.; David Davis and Paul F. Altschul, of New York, N. Y.

The People's Service Electric Company, of Trenton, N. J., has been incorporated by Claudius B. Lasell, Elmer W. Bogart and Orris M. Driscoll. The company is capitalized at $125,000 and proposes to manufacture and deal in electrical machinery.

The Electric Automobile Delivery Corporation, of New York, N. Y., has been incorporated with a capital stock of $10,000 by George Tierman, Frank H. Parcells and John B. Purcell. Beardsley, Hemms & Taylor, 50 Wall Street, New York, N. Y., are attorneys.

The Howes Electric Burglar Knob Company, of New York, N. Y., has been chartered with a capital stock of $10,000 by P. Gottlieb, C. M. Setlow and E. J. Fuller, 71 Third Avenue, New York, N. Y. The company proposes to manufacture and deal in implements and tools.

The Electric Meter Corporation, of New York, N. Y., has been incorporated with a capital stock of $50,000 to manufacture and deal in electrical apparatus, protective devices, etc. The incorporators are R. S. Harvey, K. Fairbanks and F. A. Sorgee, 55 Liberty Street, New York, N. Y.

Green, Green & Green, of Rochester, N. Y., have filed articles of incorporation with a capital stock of $10,000 for the purpose of manufacturing electrical devices, equipments and mechanical specialties. The incorporators are: W. R. Foster, A. L. and A. A. Green, 34 Livingston Street, Rochester, N. Y.

New Incorporations

The Telleride Power Company, of Dallas, Tex., has been incorporated with a capital stock of $40,000 by W. W. Clark and others.

The Hazard Power Company, of Hazard, Ky., has been incorporated with a capital stock of $25,000 by L. L. Stone and others.

The Haskell Ice & Light Company, of Haskell, Tex., has been incorporated with a capital stock of $20,000 by Morgan T. Jones, George T. Scales and W. G. Swenson.

The East Randolph Light & Power Company, of East Randolph, Vt., has been chartered with a capital stock of $5,000. The incorporators are W. A. Robbins, G. G. Boswell, H. L. Newell, V. L. Allard, F. E. Smith and J. Holden Camp, of East Randolph.

The Coldbrook Springs Electric Light Company has been organized for the purpose of installing an electric-light plant in Coldbrook Springs, Mass. The directors are: Harry B. Barker, secretary and treasurer; Guy Allen, J. Edmund Cody, Gilbert P. Butterfield, Herbert T. Needham and others.

Trade Publications

Refillable Fuses.—The A. F. Daum Company, Pittsburgh, Pa., is sending out a leaflet which describes and illustrates several types of its refillable fuses.

Wiring Devices.—Pass & Seymour, Inc., Solvay, N. Y., have prepared a leaflet designated as 12-B which lists several devices for nitrogen-filled lamps.

Lock Sockets.—The Arrow Electric Company, Hartford, Conn., has brought out an illustrated folder which contains information on its "Arrolock" socket.

Electrically Operated Blowers. — The American Blower Company, Detroit, Mich., is sending out a booklet which describes its electrically operated "Sirocco" blowers.

Flashlamp Batteries.—The Bright Star Battery Company, 430 West Fourteenth Street, New York, has issued an illustrated bulletin describing its batteries for flashlamps.

Bulletin Index.—The Fort Wayne Electric Works of the General Electric Company, Fort Wayne, Ind., have brought out a bulletin which contains a list of their publications.

Small Lighting Outfit.—A self-contained gasoline-engine-driven lighting outfit is described and illustrated in a catalog issued by the Matthews Boat Company, Port Clinton, Ohio.

Electric Welder.—The Welding Materials Company, 114 Liberty Street, New York, has prepared an illustrated catalog designated as Bulletin 1915-A on its variable-voltage arc welders.

Electric Signal Devices.—The Sireno Company, 18 Rose Street, New York, has issued a catalog on its electric warning signals and accessories for automobiles, boats and motor cycles.

Safety Device for Elevators.—The Black-Woods Manufacturing Company, 350 Knoxville Avenue, Peoria, Ill., has published a folder which describes its electrically operated safety device for elevators.

Electric Washer.—The Grinnell Washing Machine Company, Grinnell, Ia., has published a folder entitled "Over the Back Fence," which contains information on one of its electrically operated washers.

Electrically Operated Tractor.—The Mercury Manufacturing Company, 4110 South Halsted Street, Chicago, Ill., has prepared several illustrated bulletins which describe its electric industrial tractor.

Industrial Lighting.—The Cooper Hewitt Electric Company, Eighth Street and Grand Street, Hoboken, N. J., has published a booklet entitled "Light as a Factor of Efficiency," by W. A. D. Evans.

X-Ray Apparatus.—The Kelley-Koett Manufacturing Company, Covington, Ky., has published Catalog No. 22, which is illustrated and which contains information on various types of X-ray apparatus.

Electric Heating Appliances.—The American Electrical Heater Company, Detroit, Mich., has brought out a folder illustrating a display card which it is sending out as well as several of its heating appliances.

Electrically Operated Washers. — The Altorfer Brothers Company, Roanoke, Ill., has recently issued a booklet entitled "Washing Secrets," which contains information on electrically operated washing machines.

Electric Sign.—The Reynolds Electric Company, 422 South Talman Avenue, Chicago, Ill., is sending out an illustrated card designated as Suggestion No. 12 which describes a flashing electric sign suitable for theaters.

Inclosed Entrance Switches.—Bulletin No. 33 issued by the Detroit Fuse & Manufacturing Company, Detroit, Mich., contains information and illustrations of its "square D" inclosed entrance switches and distributing cabinets.

Spray and Air-Cooling Apparatus.—The Spray Engineering Company, 93 Federal Street, Boston, Mass., has prepared an illustrated booklet on sprays for cooling condensing water and also a bulletin on washing and cooling air for steam-turbine generators.

Wire and Asbestos Insulation for Wire.—The Independent Lamp & Wire Company, York, Pa., has issued a booklet describing its "Salamander" asbestos-covered magnet wire, a leaflet on its asbestos-covered wire for air-compressor coils, and several leaflets on methods of rewinding burnt-out field coils.

Lighting Fixtures.—The National X-Ray Reflector Company, Chicago, Ill., is sending out Plates No. 25, No. 26, No. 36 and No. 38, which contain diagrams and illustrations showing various types of fixtures and methods of using them in stores, railroad stations, showcases and wall cases, gymnasium and locker rooms.

Copper-Clad Wire.—Bulletin No. 201-1 recently issued by the Standard Underground Cable Company, Pittsburgh, Pa., contains information on its "Colonial" copper-clad wire. The company has also just published a booklet, entitled "Thirty-three Years of Progress," which describes its exhibit at the Panama-Pacific International Exposition.

Construction News

New England

BRISTOL, N. H.—Within the next few months the Bristol El. Lt. Co. expects to erect about 1½ miles of line in connection with proposed extension to the street-lighting system. Material has already been purchased. G. A. Emerson is treasurer.

WEST CAMPTON, N. H.—Seth Dunclee, it is understood, contemplates the installation of an electric-lighting plant in West Campton.

MONTPELIER, VT.—G. E. Moody and George Almon, of Waterbury, it is reported, have secured options on several water-powers along the Wells River and are trying to secure options on other sites with a view of building power plants along the stream.

BOSTON, MASS. — The Massachusetts Gas & Electric Commission has authorized the Edison El. Illg. Co. of Boston to issue 20,480 additional shares of capital stock at $215 per share.

SALEM, MASS.—Work will soon be begun by the Salem El. Ltg. Co. on enlarging its plant and system, involving an expenditure of about $250,000. New equipment, including a 6250-kw generator, four 750-hp Bigelow-Hornsby water-tube boilers, with furnaces, stokers, etc., will be needed. An addition will also be built to the power station. The company will also place its overhead wires in the business district underground.

PAWTUCKET, R. I.—Plans are being considered by the school committee for lighting the high school by electricity; also installing lamps in the schoolhouses on Central and Lincoln Avenues.

NORWICH, CONN.—The Rex Pwr. Co., of Norwich, has applied to the State Legislature for a charter permitting it to generate, sell and distribute electricity in New London and Windham Counties, and to begin business with a capital stock of $50,000, with privilege of increasing to $500,000 as may be found necessary. The incorporators are C. R. Alexander, James J. Donohue and C. E. Chapman.

Middle Atlantic

BABYLON, N. Y.—The Babylon Pwr. Co., recently incorporated, has applied to the Town Board for a franchise to install and operate an electric-light plant in Babylon. Daniel E. Hanlon, 2646 Morris Avenue, New York, N. Y., is interested in the company.

IROQUOIS, N. Y.—Bids will be received by William Hunt, president of board of managers, Thomas Indian School, Iroquois, N. Y., until April 23 for construction work for silo and addition to dairy barn and construction, heating, plumbing, drainage and electric work for ice house, dairy room and cold-storage plant at the Thomas Indian School, Iroquois. Drawings and specifications may be consulted at the above school at the New York office of the Department of Architecture, Room 1224 Woolworth Building, and at the Department of Architecture, Capitol, Albany.

LAKE PLACID, N. Y.—Within the next two months the village of Lake Placid expect to purchase some transformers, to cost about $500, and electric meters, costing about $200. O. Weaver is village clerk.

LESTERSHIRE, N. Y. — Preliminary steps have been taken toward the establishment of an ornamental lighting system on Main Street.

LOCKPORT, N. Y.—Bids will be received by the Board of Education, Lockport, until April 20, for equipment to be installed in the enlarged Union School Building as follows: (1) Time and program system; (2) fire-alarm system; (3) intercommunicating telephone system; (4) vacuum cleaning system; (5) construction of fire escapes. General construction plans may be seen at the office of the board.

MAYVILLE, N. Y.—The Senate has passed the Sullivan bill legalizing the Mayville bond issue to defray the expense of reconstructing and equipping the municipal electric-light plant and water-works system.

MINETTO, N. Y.—Work will soon be resumed on the construction of the new power plant of the Columbia Pwr. Co. in Minetto. The proposed plant will be situated north of the bulkheads of the new dam and will have an output of 12,000 hp. The Weatherspoon & Eingley Co., of Chicago, Ill., is the contractor.

NEW BRIGHTON, N. Y.—Within the next three months the Richmond Lt. & R. R. Co., of New Brighton, expects to extend its 6600-volt transmission lines from Concord to Midland, South Beach and Fort Wadsworth, and from Concord to Tottenville; also to purchase one 7500-kva turbo-generator set, complete with auxiliaries, two 600-hp boilers with stokers and an ash-handling system. The company has just placed in operation the Concord substation, equipped with two 500-kw units, and has also contracted for two 12,000-gal. per minute centrifugal pumps, directly connected to vertical-shaft and induction motors of 150 hp each. The contract for pumps was awarded to the Cameron Steam Pump Co., and that for motors to the Westinghouse El. & Mfg. Co. The system, which covers all of Staten Island, has been changed from a two-phase to a three-phase system, and the new switchboard building, which was started two years ago, has been completed. W. H. Rudisill is chief engineer.

NEW YORK, N. Y.—Bids will be received by Robert Adamson, fire commissioner, eleventh floor, Municipal Building, New York, until April 26 for furnishing 12 motor-driven city service hook-and-ladder trucks. Blank forms and further information may be obtained and plans and specifications may be seen at the above office.

HARRISBURG, PA.—Application has been filed with the State Department for charters for the Cassandra Lt. Co. and the Portage Township Lt. Co. by James Pearce, William H. Troxell and Nellie Pearce. The companies will supply electrical service in the towns for which they are named.

HAZLETON, PA.—The Harwood El. Co., it is reported, contemplates extending its service to Sunbury, and also plans to supply electrical service to the summer resorts in the Pocono Mountains around Stroudsburg. Energy will be supplied from the Hazleton plant.

HILLSDALE, PA.—Plans are being prepared by the Pittsburgh Coal Co., it is reported, for the construction of a power house in Hillsdale.

HOLTWOOD, PA.—The Pennsylvania Wtr. & Pwr. Co., it is reported, is contemplating enlarging its plant at Holtwood. J. E. Aldred, 24 Exchange Place, New York, N. Y., is president of the company.

NEW BRIGHTON, PA. — Preliminary steps have been taken by the Borough Council for the establishment of a municipal electric-light plant. A committee has been appointed to make an investigation of the cost of a plant.

PHILADELPHIA, PA.—The contract for the electrical installation in the 12-story apartment house at Seventeenth and Walnut Streets, Philadelphia, has been awarded to the United El. Construction Co., of Philadelphia.

PHILADELPHIA, PA.—The installation of 1008 additional arc lamps to be distributed throughout the city has been recommended by a sub-committee of the Councils' electrical committee. The finance committee of Councils has recommended the appropriation of $50,000 for this purpose.

PHILADELPHIA, PA.—Proposals are being asked by the officials of the Pennsylvania Village for Feeble-Minded Women, Union County, on the proposed contract for the installation of electricity throughout the institution. Plans and specifications and form of proposal can be obtained at the office of George S. Idell, 34 South Sixteenth Street, Philadelphia, upon deposit of $5.

PHILADELPHIA, PA.—Bids will be received by M. L. Cooke, director of the department of public works, Room 332, City Hall, Philadelphia, until April 23 for furnishing lamps and maintaining same for the illumination of streets, avenues, boulevards, sidewalks, bridges, etc., in the city of Philadelphia. Specifications and blank forms can be obtained upon application at the office of the Bureau of Lighting, Room 322, City Hall.

ROCHESTER MILLS, PA.—A movement is on foot to secure electric-lighting service in Rochester Mills and for farmers along the proposed line between Marion Center and this place. The Clymer El. Co., of Dixonville, which supplies electrical service in Marion Center, has agreed to extend its line, provided that sufficient patronage is secured to justify the expenditure.

SALEMVILLE, PA.—The power plant of the Keystone Coal & Coke Co. at Salemville is reported to have been damaged by fire recently, causing a loss of between $6,000 and $7,000.

WAMPUM, PA.—The Borough Council has decided to sell the municipal electric-light system. The Pennsylvania Pwr. Co., Ellwood City, which has supplied energy to operate the system, it is reported, is considering purchasing the plant.

NEWARK, N. J.—The Board of Works has decided to install about 73 arc lamps of 600 cp on Orange Street in the Roseville section. The Public Ser. El. Co. will make the installation.

PERTH AMBOY, N. J.—Bids will be received by the Board of Aldermen, City Hall, Perth Amboy, N. J., until April 26 for construction of a municipal electric-lighting plant as follows: (1) Construction of power station, including excavation, grading, foundations, building and traveling crane; (2) oil engines, generators, switchboards, constant-current transformers, pumps, station heating and wiring apparatus and electric lamps in building; (3) electrical work, including outside distributing system, both overhead and underground construction. Proposals may be rendered for any one or two of the items or for the entire installation. Plans and specifications may be seen at the office of Runyon & Carey, consulting engineers, 845 Broad Street, Newark, N. J. Copies of plans and specifications may be obtained of the engineers upon deposit of $50, to be refunded upon return of same. Wilbur A. Roe is city clerk.

TRENTON, N. J.—Bids will be received by the committee on grounds and buildings of the Board of Education at the office of the business manager, Administration Building, 9 Stockton Street, Trenton, until April 29, for construction of school building, to be known as the Junior High School No. 1, in accordance with plans and specifications, copies of which may be obtained at the above office. Separate bids must be submitted for plumbing, heating, ventilation and electric wiring. William A. Poland is business manager.

CUMBERLAND, MD.—The Edison El. Illg. Co., of Cumberland, has nearly completed its new 5000-kw generating plant and is erecting about 14 miles of new transmission line. Contracts for material have been awarded. W. M. Roberts, Jr., is general manager.

LAUREL, MD.—Bids will be received by George W. Waters, Jr., Mayor, Laurel, until May 1 for construction of complete system of sanitary sewers, extensions to water mains and other water-works improvements, including motor-driven pumping machinery. Plans and specifications may be seen at the office of the collector, Laurel, or at the office of Harry Stevens, consulting engineer, Union Trust Building, Washington, D. C. Copies may be obtained from the engineer for $5 per set.

HUNTINGTON, W. VA.—The Virginia Pwr. & El. Co., of Charleston, it is reported, is contemplating the construction of an electric railway from Huntington to St. Albans, where it will connect with the system of the Charleston Interurban Ry. Co.

SPRIGG, W. VA.—The Tugg River Pwr. Co., of Gary, W. Va., it is reported, has awarded contract for construction of power plant, to cost $30,000, to Carlin, Clark & Walker, of Welch.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until April 24 for lamp standards, lamp brackets, lanterns, etc., under the control af the Treasury Department, in accordance with drawings and specifications, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the chief clerk of the Post Office Department, Washington, D. C., until April 20, for rewiring the Post Office Department Building, at the corner of Twelfth Street and Pennsylvania Avenue, Northwest, Washington. Specifications may be obtained from the chief clerk of Post Office Department. A. S. Burleson is postmaster-general.

WASHINGTON, D. C.—Foreign trade opportunities are announced by the Bureau of Foreign and Domestic Commerce in the Commerce Reports as follows: No. 16,302—One of the foreign legations in Washington, D. C., informs this bureau that an automobile manufacturer is desirous of forming commercial relations with firms in the United States which are in a position to supply "magnetos" to be used in the manufacture of one, two and three-cylinder motor cars. No. 16,307—An American consular officer in Canada reports that a large church building is to be erected in his district in the near future, at a cost of $75,000. The committee in charge desires to receive catalogs, quotations, etc., for structural steel, glass, heating and ventilating apparatus, lighting fixtures, general church furniture and organs. No. 16,182—A firm in England, which is engaged in manufacturing incandescent lamps, has informed an American consular officer that it desires to purchase brass caps and glass bulbs used in the manufacture of electric lamps. No. 16,369—A safety-lamp company in England informs an American con-

sular officer that it desires to secure the names and addresses of American manufacturers of miners' electric-lamp cases. Further information may be obtained from the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., or its branches.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 4 for furnishing at the various navy yards and naval stations supplies as follows: Melville Station, R. I., Schedule 8198—miscellaneous plow-steel cable. Brooklyn, N. Y., Schedule 8189—450 prismatic reflectors; Schedule 8185—7500 ft. lighting and power wire; Schedule 8182—miscellaneous seamless drawn copper pipe. Newport, R. I., Schedule 8179—10,000 ft. double-conductor cable; Schedule 8200—200 lb. uncut sheet mica, 2000 lb. self-fluxing solder, 500 lb. cold-rolled sheet copper, miscellaneous ebonite tubing, miscellaneous half-hard brass tubing. Philadelphia, Pa., Schedule 8176—miscellaneous three-conductor cable; Schedule 8198—six switchboard panels. Norfolk, Va., Schedule 8178—miscellaneous three-conductor cable; Schedule 8179—miscellaneous telephone cable, three 50-kw transformers; Schedule 8190—58,300 lb. admiralty metal condenser tubes, 6000 lb. brass tubing Bids will also be received at the same place until May 11 as follows: Mare Island, Cal., Schedule 8194—800 lb. medium rolled bronze rod; Schedule 8196—1500 lb. amorphous lubricating graphite; Schedule 8184—miscellaneous telegraph steering indicator, 6500 steel boiler tubes, 16,400 lb condenser tubes; Schedule 8173—one 1-ton ice machine. Applications for proposals should give the schedule desired by number.

North Central

CLARE, MICH.—At an election held April 5 the proposal to issue $34,000 in bonds for the installation of a municipal electric-lighting plant was defeated.

CLIO, MICH.—The Commonwealth Pwr. Co., of Jackson, has entered into an agreement with J. H. O'Rourke, owner of the local electric-light plant, to purchase the plant and system, provided that the company is granted a new franchise by the Council.

DOWAGIAC, MICH.—The City Council has decided to call an election to submit to the voters the proposal to issue $10,000 in bonds for the purpose of rebuilding the municipal electric-light plant and the waterworks system.

HASTINGS, MICH.—The Thornapple Gas & El. Co., of Hastings, expects to erect a concrete block substation at Lake Odessa, for which all material has been purchased except wall bushing for 25,000 volts. The work will be done by the company. The company expects to purchase within the next 30 days one set 25,000-volt pole-top, out-door-type, three-pole transmission-line sectionalizing switches for voltage of Middleville. It will also rebuild the overhead distribution system at Lake Odessa, for which material has already been purchased. L. W. Heath is manager.

IRON RIVER, MICH.—The Iron Range Lt. & Pwr. Co., of Iron River, expects to purchase lightning arresters for a 2300-volt distribution system. M. D. Parks is superintendent.

LAPEER, MICH.—Within the next three months the Lapeer Gas-El. Co. expects to rebuild its distribution lines in the business section of the city. C. D. Hulbert is superintendent.

MAYFIELD, MICH.—Within the next six months Mrs. J. L. Gibbs, owner of the local electric-lighting plant, expects to purchase a series street-lighting system. Joseph Scott is electrician.

SCHOOLCRAFT, MICH.—Bids will be received by O. A. Fellows, village clerk, Schoolcraft, until April 27 for construction of water-works system as follows: (1) Changes in electric-light station, including office, pump and valve pit and pump foundations, but exclusive of piping and pumping machinery; (2) for pumps and motor; (3) setting pumps and motor and furnishing all piping and valves inside of station and pit, connecting same to pumps and boilers; (4) piping between wells, elevated tank and valve pit; (5) distribution system complete, exclusive of items 3 and 4, and including all piping, valves and hydrants; (6) elevated tank complete; (7) foundations for elevated tank; (8) service connections. Plans and specifications can be seen and blank forms obtained at the office of the village clerk or at the office of the Smith & Boulay Co., 320 The Nasby, Toledo, Ohio.

CINCINNATI, OHIO.—The Diamond Lt. Co., of Cincinnati, has applied to the City Council for a franchise to operate an electric-light plant in this city. The company asks specifically for authority to lay and maintain conduit under and through Thorpe, Hatters and Fountain Alleys.

CLEVELAND, OHIO.—Bids for the electric-lighting fixtures for the new city hall, it is reported, will soon be asked. The cost is estimated at about $65,000.

CLEVELAND, OHIO—Bids will be received at the office of the commissioner of purchases and supplies, Room 511, City Hall, Cleveland, until April 23 for paper-insulated, lead-covered cable for the Municipal Electric Light Department. Specifications may be obtained at the office of the commissioner of light and heat division, 1443 East Third Street. A. R. Callow is commissioner of purchases and supplies.

DEGRAFF, OHIO.—The Board of Public Service expects to install within the next two months three 50-hp International oil engines, one 37½-kva and one 60-kva, three-phase, 2250-volt induction Triumph motor. J. T. Scott is superintendent.

FINDLAY, OHIO.—The Toledo, Bowling Green & Southern Trac. Co. will install a new street-lighting system in Findlay. The plans provide for incandescent lamps (type C) to be equipped with refractors; in the residence district 221 lamps of 250 cp will be installed, 186 of 100 cp and 52 of 600 cp; 88 ornamental standards will be erected in the business section. The cost of the system is estimated at about $20,000. The lamps and fixtures will be furnished by the General Electric Co. Ornamental trolley and lamp poles will be supplied by the El. Ry. Equipment Co., of Cincinnati. Daniel Riedel is superintendent of motive power.

GARRETTSVILLE, OHIO—Within the next four months S. H. Bruce, owner of the local electric-lighting plant, expects to erect 8 miles of three-phase, 6600-volt transmission line and to purchase some 6600-volt transformers; also some 2300/6600-volt transformers.

GREENFIELD, OHIO—The Board of Public Service contemplates the purchase of automatic engine stops for the municipal electric-light plant within the next few months; also within the next two months to purchase poles, meters and incandescent lamps (quantity not yet decided upon), and will also probably need within a short time some electrical heating devices and wiring supplies.

HAMILTON, OHIO—Within the next two months the Board of Public Service expects to purchase ornamental lamp standards and material for lighting system for three squares. James O'Toole is superintendent.

JAMESTOWN, OHIO.—Within the next three months the Jamestown El. Lt. Co. expects to purchase one or two 60-cycle, single-phase or three-phase, 2300-volt generators (revolving field, 130 amp), some poles, and probably some meters. S. A. Brown is superintendent.

MASSILLON, OHIO.—The City Council has adopted a resolution asking for the reconstruction of the street-lighting system.

NORWALK, OHIO.—The Supreme Court has overruled the appeal of the Cleveland, Southwestern & Columbus Ry. Co., in its suit against the city of Norwalk, questioning the legality of the $120,000 bond issue by the city of Norwalk for the erection of a municipal electric-light plant.

ST. CLAIRSVILLE, OHIO.—The City Council has awarded the contract for energy for operating the local system to the Sunnyside Electrical Co. The city has decided to abandon the municipal plant.

SHELBY, OHIO.—The Ohio Lt. & Pwr. Co., of Tiffin, has submitted a proposal to the Council offering to supply electricity in Shelby from its plant in Tiffin. The city of Shelby, it is reported, is contemplating making improvements to the municipal electric-lighting plant, to cost about $40,000.

VERONA, OHIO.—The Public Utilities Commission of Ohio has authorized the Brookville & Lewisburg Ltg. Co. to issue $5,000 in capital stock, the proceeds to be used to erect an electrical distributing system in the towns of Verona and Gordon for the purpose of supplying electrical service in both towns.

HUSTONVILLE, KY.—The local electric-light plant is reported to have been purchased by Walter Owsley. It is understood that the equipment will be removed from the Hustonville Roller Mills, where it now is, to the power house now being erected by Mr. Owsley. A new 25-hp engine, which has already been purchased, will be installed. When completed, a 24-hour service will be established.

LOUISVILLE, KY.—Residents of Auburndale, a suburb of Louisville, several miles to the south, are negotiating with the Louisville Gas & El. Co. for extension of the service to that locality. The company has given assurances that wires will be extended south as far as the junction of the Third Street Road and the New Cut Road, but the Auburndale residents want the lines to go still further and pass through their community.

PEMBROKE, KY.—Within the next 12 months the South Kentucky Pwr. Co., of Pembroke, expects to erect 20 miles of transmission line, and to purchase material for same, including poles, transformers, wire, insulators, etc. The company purchases energy from the electric plant in Hopkinsville. It also operates a system in Trenton, Ky. S. G. Ragsdale is manager.

STITHTON, KY.—The Greenup El. Co., recently incorporated with a capital stock of $10,000, is contemplating establishing electric plants at Sonora and West Point. The company is now operating electric plants in Stithton, Horse Cave, Munfordville and Brandeburg, and it is also part owner in plants at Edmonton and Burksville.

ALTON, ILL.—The State Board of Administration, it is reported, will soon award contracts for the construction of a new power house at the Alton Hospital.

STRONGHURST, ILL.—Within the next two months M. F. T. Schierbaum, owner of the local electric-light plant, expects to erect an extension to the power station to provide space for additional machinery; also to purchase within the next three or four months one 40-kw to 45-kw revolving-field, three-phase, 60-cycle, 1100-volt generator and possibly some new transformers. It is proposed to replace the present steam plant with a gas engine. Contracts have been closed for one Muenzel suction gas producer and engine of 60 hp.

KAUKAUNA, WIS.—Within the next 30 days the Municipal Electric and Water Department expects to purchase one 240-kw, 25-62½-cycle frequency changer and switchboard for the municipal electric-light plant. W. B. Montgomery is manager.

MISHICOT, WIS.—Within the next six months Ira Beyer, owner of the local electric-lighting plant, expects to purchase one waterwheel governor, one 75-hp steam engine and two boilers.

MILAN, MINN.—Bids will be received by C. R. C. Blom, clerk of School District No. 45, Milan, until May 4 for construction of brick high-school building in accordance with plans and specifications prepared by C. E. Edwins, architect, 911 Northwestern Building, Minneapolis, Minn. Separate bids to be submitted as follows: For general contract work, for heating and plumbing, and for electric wiring. Plans may be seen at the office of the clerk at Milan, and at the Builders' Exchange at Minneapolis. Copies may also be procured from the architect.

STAPLES, MINN.—The Water and Light Commission is contemplating the installation of a new street-lighting system, consisting of about 85 lamps.

BONAPARTE, IA.—Plans are being considered for the installation of an electric-lighting plant in the school at Bonaparte. Underhill & Dean, 612 Bryant Building, Kansas City, Mo., are architects.

BRAYTON, IA.—The Brayton El. Lt. Co. is installing an electric plant, the equipment to include a 25-hp crude-oil engine (now being installed), one 50-hp engine (to be installed next fall), two alternating-current generators (one 18½ kva and one 37½ kva), and Maloney transformers. The distributing system will require from 14 to 16 miles of wire and from 50 to 55 poles per mile. George G. Heogh is proprietor and manager.

HARLAN, IA.—Within the next three months the city of Harlan expects to purchase one carload of poles, with three-conductor, lead-covered cables, for the municipal electric-lighting system and will also let contract for yearly supply of incandescent lamps. C. D. Lutton is superintendent of light and water plant.

LORIMOR, IA.—An electric light and power plant is being erected in the town of Lorimor. J. F. Smith, recently granted a franchise, is reported to be interested in the project.

MASON CITY, IA.—The People's Gas & El. Co., of Mason City, expects to complete within the next two weeks a transmission line to the city limits which will supply electricity to the town of Nora Springs. The company has also purchased a 3000-kw turbine, together with necessary condensing equipment, switchboard, etc. M. Anderson is general manager.

MOORHEAD, IA.—Preparations, it is reported, are being made for the installation of an electric-lighting plant in Moorhead, to cost about $10,000. N. P. Sorenson and George Gullison are owners.

OSCEOLA, IA.—The property of the Osceola Lt., Ht. & Pwr. Co. has been purchased

by the Union Co., of Omaha, Neb. The latter company will erect about 40 miles of transmission lines and also rebuild the gas plant. Willis Todd, of Omaha, is secretary and manager of the Union Company.

URBANA, IA.—The City Council has awarded the contract for the installation of ornamental lamps on three blocks to the Standard Electric Co., of Waterloo.

WATERLOO, IA.—The Citizens' Gas & El. Co., of Waterloo, it is reported, contemplates the installation of a new power plant in Waterloo and the erection of a 40,000-volt transmission line, connecting this city with Charles City, Marble Rock and other towns.

CARUTHERSVILLE, MO.—The Public Service Commission has authorized the sale of the property of the Caruthersville Ice & Lt. Co., of Caruthersville, and the Kennett Ice & El. Co., of Kennett, to the Caruthersville & Kennett Lt. & Pwr. Co.

ST. LOUIS, MO.—The question of establishing a municipal electric-lighting plant in St. Louis is being agitated.

FORBES, N. D.—Messrs. Hixson & Leet, it is reported, have been granted a franchise to construct and operate an electric-lighting plant in Forbes.

GRAND FORKS, N. D.—Bids will be received by F. F. Burchard, Secretary of the Board of Education of Independent School District of the city of Grand Forks, City Hall, Grand Forks, until April 27 for the construction of the first unit of a new high school. Separate bids to be submitted on the general contract work, heating and ventilating, plumbing work and the electric work, in accordance with drawings and specifications prepared by W. J. Edwards, architect, Grand Forks. Copies of plans and specifications may be seen at the office of the architect, Grand Forks; and at the Builders' Exhange at Grand Forks, Duluth, St. Paul and Minneapolis, Minn.

GOODWIN, S. D.—H. E. Rohweder is contemplating installing an electric light and power plant in Goodwin.

LEIGH, NEB.—Plans are being considered for the installation of an electric-lighting plant in Leigh. For further information address the city clerk.

RANDOLPH, NEB.—New equipment has recently been installed in the municipal electric-light and water-works plant, consisting of one 50-hp Adams oil engine and one 30-kw, 220-volt Western Electric flywheel-type generator. G. D. Wiley is superintendent.

STAMFORD, NEB.—Contracts have been awarded by David Elder for the installation of an electric-light plant in Stamford. The equipment will include one oil engine (20 hp to 40 hp), one 16-kw, 125-volt direct-current Western Electric generator, switchboard and other apparatus.

CONCORDIA, KAN.—The Concordia El. Lt. Co. is erecting a 23,000-volt transmission line to connect Clyde, Palmer, Lynn, Greenleaf and Washington. L. R. Green is vice-president.

EUREKA, KAN.—The Eureka El. & Ice Co. has just completed a new power house to consolidate the electric property with the ice plant. The equipment includes three 150-hp boilers, two Corliss engines, aggregating 350 hp, two 225-kw, three-phase, 60-cycle, 2300-volt generators and a 20-ton York ice plant. The distribution system has been entirely rebuilt and a new street-lighting system installed, and also 30 ornamental lamp standards. R. G. Lafite is owner.

Southern States

PLYMOUTH, N. C.—At an election to be held May 4 the proposal to issue $12,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters.

SWANN QUARTER, N. C.—Bonds to the amount of $3,000 have been sold, the proceeds to be used for street-lighting and street improvements.

ZEBULON, N. C.—An election will soon be called to submit to the voters the proposal to issue $8,000 in bonds. Of the proceeds, $6,000 is to be used for the installation of an electric-lighting plant.

ANDERSON, S. C.—The Southern Pub. Utilities Co., of Anderson, expects to erect within the next two months one 3000-kw outdoor-type transformer substation, also one three-panel switchboard and switchhouse to control above transformers and to install four 100-kw boosting transformers at the Portman power house; also within the next 30 days to install one 25-lamp street-lighting circuit. All material has been purchased. H. A. Orr is local manager.

SAVANNAH, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 1, for remodeling an electric elevator in the United States post office and court house in Savannah. For details see proposal columns.

PANAMA CITY, FLA.—The Town Council has granted J. B. Bell, of Dothan, Ala., a franchise to install and operate an electric-light plant in Panama City.

SOUTH JACKSONVILLE, FLA.—Extensions and improvements will be made to the municipal electric-lighting plant, water-works and sewer system, involving an expenditure of about $25,000. New machinery will be installed, consisting of one four-valve and uniflow engine for direct connection to either a 125-kva, a 150-kva or a 175-kva generator with exciter and switchboard, one 60-hp, 600-r.p.m. motor, one set of gears and feed pump, bids for which will be received April 19. The J. B. McCrary Co., Third National Bank Building, Atlanta, Ga., is engineer.

MANCHESTER, TENN.—The Tennessee Valley Lt. & Pwr. Co. contemplates the erection of a transmission line from Winchester to Manchester to supply electricity here. The company has recently acquired the local electric plant. H. W. Foote is local manager.

BESSEMER, ALA.—Mayor Lewis, it is reported, will ask the City Council to authorize the sale of $40,000 municipal bonds voted in April, 1901, for the installation of a municipal lighting plant for Bessemer. These bonds have never been offered for sale.

FLORENCE, ALA.—The federal government has authorized Messrs. Sprague & Henwood, contractors, of Scranton, Pa., to proceed with their contract to bore foundations for two dams across the Tennessee River at Muscle Shoals. One dam is to be built within the city limits of Florence, and the other dam about 20 miles up the river. Congress has appropriated $150,000 for this and other preliminary work. The plans contemplate the development of about 680,000 hp for transmission by electricity.

GURLEY, ALA.—Preparations are being made by Henry Smith, owner of the local electric-light plant, to rebuild the plant, which was damaged by fire. The cost of the work is estimated at about $2,500.

HUNTINGTON, ARK.—The capital stock of the Coal & Gas Belt El. Co. has been increased from $50,000 to $75,000.

STUTTGART, ARK.—The City Council has engaged F. L. Wilcox, Syndicate Trust Building, St. Louis, Mo., consulting engineer, to prepare plans for a municipal electric-light plant and water-works system for Stuttgart, to cost about $100,000.

HUGO, OKLA.—The Hugo Ice & Lt. Co. expects to install within the next two months one 500-kw Allis-Chalmers turbine-driven generating unit with Wheeler condenser and all necessary auxiliaries and one 406-hp Heine water-tube boiler. Contracts have been placed for equipment. J. W. Dawley is manager.

BEAUMONT, TEX.—The Beaumont El. Lt. & Pwr. Co. expects to install a complete new street-lighting system, consisting of 4-amp alternating-current magnetic arc lamps to replace the 6.6-amp series arc lamps now in use. J. W. Thorne is commercial agent.

FREEPORT, TEX.—The City Council is contemplating extending the street-lighting system to cover the residential section. Ornamental lamps have been erected in the business portion.

LAMPASAS, TEX.—Within the next 50 days the Lampasas Lt. & Pwr. Co. expects to install a 50-kw, three-phase generator and also a complete set of new ceiling and desk fans. Emil Haby is owner and manager.

McKINNEY, TEX.—The city of McKinney expects to purchase within the next six months a 200-kw, two-phase, 60-cycle, 2300-volt generating unit, directly connected. W. E. McKinnon is superintendent.

MARFA, TEX.—Plans are being considered by B. Q. Musgraves, of Fort Worth, and associates for the construction of an interurban electric railway between Marfa and Fort Davis, a distance of 18 miles. Eventually the railway will be extended from Port Davis to Balmorhea, an additional 30 miles. The construction of an electric plant is included in the project.

PALACIOS, TEX.—Charles H. Trego, owner of the local electric-light plant, is installing a 60-hp oil engine of the semi-Diesel type, and will also install a 35-kw or 40-kw alternating-current generator during the summer. When improvements are completed the entire steam plant will be discarded.

POST, TEX.—The Post Pwr. Co. is contemplating the installation of an electric-lighting system in Post.

Pacific States

SEATTLE, WASH.—Bids will be received by the Board of County Commissioners of King County, Court House, Seattle, until May 3 for furnishing and installing electric fixtures in the new King County court house (under construction) at Third Avenue and Jefferson Street, Seattle. The cost of the work is estimated at $25,000.

LONG BEACH, CAL.—Plans are being considered for the installation of an ornamental lighting system on Long Beach Boulevard, extending along the frontage of Norton's Lynwood Acres and into the heart of Long Beach. The Chamber of Commerce of Long Beach has appointed a committee to take charge of the plans.

LOS ANGELES, CAL.—The Board of Public Service Commissioners has authorized E. F. Scattergood, chief electrical engineer of the power bureau, to proceed with plans for the lighting of the city streets with energy generated by the municipal aqueduct power plant.

RIVERSIDE, CAL.—The electric plant of the Pacific Lt. & Pwr. Corpn. in Riverside was recently destroyed by fire.

SAN BERNARDINO, CAL.—The installation of an ornamental street-lighting system on Third Street, from Arrowhead Avenue to the viaduct, is under consideration by the local business men.

SAN FRANCISCO, CAL.—The State Railroad Commission has granted the Coast Valleys Gas & El. Co., of San Francisco, permission to issue $10,000 in bonds for extension to its plant in the vicinity of Kings City. The commission states that it will reconsider a re-submission of the application of the company for $100,000 in bonds as soon as the question of its liability as guarantor of $300,000 of the bonds of the Monterey & Pacific Grove railway has been determined.

TEHACHAPI, CAL.—The Board of Trustees has adopted a resolution declaring that the installation of an electric light and power plant is a necessity. The cost of the plant is estimated at $8,000.

PARK CITY, UTAH—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 13, for construction complete, including mechanical equipment, interior lighting fixtures and approaches, of the United States post office in Park City, Utah. Drawings and specifications may be obtained at the above office or from the custodian of site at Park City, Utah.

CASA GRANDE, ARIZ.—Application has been made to the Town Council by F. B. Brackett for a franchise to construct and operate an electric-lighting plant in Casa Grande. An election will soon be called to submit the franchise to the voters.

COKEVILLE, WYO.—Plans are being considered by local business men for the installation of an electric-lighting plant in Cokeville.

DENVER, COL.—Plans have been completed by the Eight and Broadway Men's Commerce Club for the installation of additional ornamental standards on Broadway between Speer Boulevard and Eleventh Avenue.

Miscellaneous

PANAMA—Bids will be received at the office of the general purchasing officer, the Panama Canal, Washington, D. C., until April 27 for furnishing galvanized steel, tool steel, steel boiler tubes, wire cable, electric cable, steel wire, chain, cable clips, wire staples, etc. Blanks and general information relating to this circular (No. 915) may be obtained at the above office or at the office of the assistant purchasing agents, 24 State Street, New York, N. Y.; 614 Whitney-Central Building, New Orleans, La., and 1086 North Point Street, San Francisco, Cal.

PONTA DELGADA, ST. MICHAEL'S, AZORES.—Bids will be received by Luis Gomes, civil engineer, St. Michael's, for complete electrical equipment for an electric-lighting plant for the city of Ponta Delgada, on the island of St. Michael's, including 500 incandescent street lamps of 16 cp, 2100 meters of wire and a crude-oil engine of sufficient power to drive the plant. When final decision is made steam power may be substituted for the crude oil engine. The cost of the proposed plant is estimated at $50,000.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 6, 1915.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York, N. Y.]

1,134,093. ELECTRIC BATTERY; W. C. Bauer, Evanston, Ill. App. filed Oct. 31, 1910. Nitro compounds; alkaline electrolytes.

1,134,105. ELECTRICAL SIGNAL SYSTEM FOR HOSPITALS; M. O. Burt, Colorado Springs, Col. App. filed Feb. 3, 1912. Silent signal in hall and audible signal in attendant's room.

1,134,107. APPARATUS FOR THE TREATMENT OF SEWAGE; T. Craney, Bay City, Mich. App. filed Feb. 24, 1914. Separation of solids and sterilization.

1,134,119. CABLE ARMOR; H. R. Gilson, Beaver, Pa. App. filed Aug. 14, 1911. Interlocking coils with flat exposed surfaces.

1,134,120. CONNECTOR FOR WOOD TO METAL MOLDING; H. R. Gilson, Beaver, Pa. App. filed Dec. 12, 1913. For joining metal and wooden molding.

1,134,127. CRYSTALLINE FERROSILICON AND METHOD OF MAKING THE SAME; H. C. Harrison, Lockport, N. Y. App. filed July 30, 1909. Chemically proportions a ferrosilicon furnace charge.

1,134,128. FERROSILICON PRODUCT AND METHOD OF CONTINUOUSLY PRODUCING THE SAME; H. C. Harrison, Lockport, N. Y. App. filed Dec. 1, 1909. Gravitates the melted iron to the molten bath below the reduction zone.

1,134,133. COMBINED JUNCTION BOX AND REFLECTOR CASING; P. M. Hotchkin, Chicago, Ill. App. filed June 1, 1914. For showcases and the like.

1,134,137. DEVICE FOR PRODUCING ELECTRIC PULSATIONS; J. F. Kelly, Pittsfield, Mass. App. filed Sept. 28, 1912. For vibrating musical strings.

1,134,148. ARC-LIGHT ELECTRODE; W. R. Mott, Lakewood, Ohio. App. filed June 6, 1913. Carbon, salt of calcium and precipitated silica.

1,134,196. ELECTRIC-MOTOR CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 2, 1913. For rapidly and uniformly reducing the motor speed.

1,134,197. DYNAMIC BRAKING CONTROLLER; C. T. Henderson, Milwaukee, Wis. App. filed Oct. 14, 1913. For motors; alternating current.

1,134,222. PORTABLE SELF-CONTAINED ELECTRIC PLANT; W. H. Palmer, Jr., Wyncote, Pa. App. filed Feb. 9, 1914. Can be shipped knocked down without breaking the electrical connections.

1,134,230. AUTOMATIC SWITCHING MECHANISM; J. G. Roberts, Dobbs Ferry, N. Y. App. filed March 10, 1906. For automatic telephones.

1,134,236. MICROPHONE; H. E. Shreeve, Millburn, N. J. App. filed May 25, 1911. Packing of the comminuted material is prevented.

1,134,244. REGULATION OF DYNAMO-ELECTRIC MACHINES; L. L. Tatum, Milwaukee, Wis. App. filed Feb. 11, 1910. Flywheel motor-generator.

1,134,256. SIGNALING DEVICE; C. B. Camp, Chicago, Ill. App. filed April 15, 1912. Automobile horn.

1,134,268. WINDING MACHINE; M. Helm, Berlin, Germany. App. filed Jan. 4, 1913. For winding alternate layers of wire and insulation.

1,134,282. TELEPHONE KEY; G. E. Mueller, Aurora, Ill. App. filed March 1, 1907. For signaling one of a number of substations.

1,134,308. TELEPHONE-EXCHANGE SYSTEM; J. L. Wright, Washington, D. C. App. filed May 18, 1906. Automatic; avoids use of ground connections.

1,134,320. APPARATUS FOR THE ATTAINMENT OF CORRECT BREATHING; V. Drew, London, England. App. filed July 6, 1914. Gives a signal upon each correct inspiration.

1,134,337. ELECTRICAL SYSTEM OF DISTRIBUTION; A. S. Hubbard, Belleville, N. J. App. filed Feb. 10, 1909. Booster and battery control.

1,134,338. ELECTRICAL SYSTEM OF DISTRIBUTION; J. W. Jepson, Depew, N. Y. App. filed Dec. 21, 1911. Train lighting.

1,134,346. ELECTRIC-LAMP REGULATOR; C. C. Oberly, Chicago, Ill. App. filed May 4, 1914. For the carbon-pile resistance of a train-lighting system.

1,134,355. CIRCUIT-CONTROLLING DEVICE; W. P. Seng, Chicago, Ill. App. filed May 21, 1912. For operating horn without removing hands from steering wheel.

1,134,356. CIRCUIT CLOSER FOR MOTOR-VEHICLE ELECTRIC HORNS; W. P. Seng, Chicago, Ill. App. filed Sept. 7, 1912. Has a switch to prevent tampering with horn.

1,134,360. SIGNAL HORN AND LAMP; P. Walker, Detroit, Mich. App. filed March 17, 1914. Mounted in a single casing with the lamp in front of the horn.

1,134,371. CURRENT-SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; W. F. Bryan and R. P. Phronebarger, Charlotte, N. C. App. filed June 24, 1914. Shoe on car engages with spaced contacts on the track.

1,134,422. ELECTRIC SWITCH; H. F. Stratton, Cleveland, Ohio. App. filed July 27, 1911. Magnetically operated for controlling alternating-current motors.

1,134,435. TELLTALE SYSTEM FOR ELECTRIC CIRCUITS; C. E. Beach, Binghamton, N. Y. App. filed Nov. 13, 1914. To indicate running down of electromechanical gongs, etc.

1,134,440. ELECTRO-PNEUMATIC BRAKE; J. W. Cloud, London, England. App. filed Dec. 20, 1913. Improved emergency application.

1,134,448. ELEVATOR SIGNAL; R. H. Gaylord, Pasadena, and C. B. Capps, Los Angeles Cal. App. filed July 25, 1914. Signal appears in car predetermined time before car reaches floor.

1,134,661—Electric Heating Device

1,134,452. THERMO-ELECTRIC BATTERY FOR MOTOR VEHICLES; L. E. Hale, Stockton, Cal. App. filed Nov. 20, 1913. Thermopile attachable to exhaust conduit of motor.

1,134,534. AUTOMATIC ELECTRICAL SWITCH; W. H. Hill, Oakwood, Ohio. App. filed Feb. 8, 1915. Magnet operates rotary circuit controller.

1,134,547. CIRCUIT CLOSER; W. C. Neahr, Denver, Col. App. filed July 31, 1912. For crossing signals; operated by vibration of rail.

1,134,565. BOX CONNECTOR FOR ELECTRIC INSTALLATION; W. H. Vibber, New London, Conn. App. filed Jan. 15, 1914. Clamp for armored cable end.

1,134,583. PROCESS AND APPARATUS FOR PRODUCING CHEMICAL ACTION IN GASES; C. S. Bradley, New York, N. Y. App. filed May 1, 1909. Fixation of atmospheric nitrogen.

1,134,593. RECEIVING SYSTEM FOR ELECTROMAGNETIC RADIATIONS; L. de Forest, New York, N. Y. App. filed May 5, 1910. Eliminates interference.

1,134,594. MEANS FOR INCREASING THE STRENGTH OF ELECTRIC CURRENTS; L. de Forest, Palo Alto, Cal. App. filed April 11, 1912. For telegraphic or telephonic signals either with or without live wires.

1,134,640. CAR-SIGNALING DEVICE; H. Rowntree, Chicago, Ill. App. filed May 22, 1911. For signaling safe starting conditions to motorman.

1,134,659. SYSTEM OF DISTRIBUTION; E. C. Wright, Newport, Ky. App. filed Sept. 3, 1907. Connecting dissimilar dynamo-electric machines in parallel.

1,134,661. ELECTRIC HEATING DEVICE; McGerry Allmayer, Chicago, Ill. App. filed Oct. 9, 1911. Immersion heater carrying a container for coffee or the like.

1,134,673. CONNECTOR; H. A. Douglas, Chicago, Ill. App. filed Aug. 9, 1912. Special plug construction

1,134,732. ELECTRIC SYSTEM; F. P. Gates, Hartford, Conn. App. filed Sept. 23, 1913. Quick make-and-break key socket.

1,134,739. ELECTRIC-MOTOR BRAKE; A. E. Handy, Brooklyn, N. Y. App. filed July 23, 1912. Operated by magnetic flux of the motor.

1,134,750. OVERLOAD CIRCUIT-BREAKER; D. Larson, Yonkers, N. Y. App. filed Oct. 14, 1911. May be reset from distant point.

1,134,752. MOTOR-PROTECTING CIRCUIT-BREAKER; J. T. Leonard, Wichita, Kan. App. filed March 20, 1913. For multiphase motors.

1,134,758. ELECTROMAGNETIC SIGNALING APPARATUS; C. H. North, Cleveland, Ohio. App. filed Feb. 9, 1907. Magnetic and mechanical improvements in harmonic bell ringer.

1,134,767. METALLURGY OF COPPER; E. A. C. Smith, New York, N. Y. App. filed Feb. 10, 1913. Recovered as electrolytic copper.

1,134,776. INDUCTION MOTOR; E. Thomson, Swampscott, Mass. App. filed Dec. 11, 1913. Secondary winding having high and low resistance parallel circuits.

1,134,779. ELECTROMAGNETS; A. R. Trezise, Sr., Brooklyn, N. Y. App. filed Aug. 5, 1913. Has a Scotch-glass guide tube for the core thereof.

1,134,784. VAPOR-ELECTRIC LAMP OR RECTIFIER; E. Weintraub, Schenectady, N. Y. App. filed July 11, 1903. Improvements in starting and in maintaining the vacuum.

1,134,785. VAPOR-ELECTRIC APPARATUS; E. Weintraub, Schenectady, N. Y. App. filed March 23, 1903. Inductance to oppose excessive current flow between the two supply mains.

1,134,786. RECTIFYING ALTERNATING CURRENT; E. Weintraub, Schenectady, N. Y. App. filed March 23, 1903. Consumption circuit extending from the negative electrode.

1,134,787. RECTIFYING ALTERNATING CURRENT; E. Weintraub, Lynn, Mass. App. filed March 13, 1903. Condensing chamber with elbows and an anode in each elbow.

1,134,788. ELECTRIC TERMINAL; E. Weintraub, Lynn, Mass. App. filed Sept. 18, 1914. Aluminum and silicon terminal for silicon conductor.

1,134,817. ELECTRIC FURNACE; J. W. Brown, Lakewood, Ohio. App. filed Jan. 8, 1912. Arc furnace of continuous type for manufacture of graphite.

1,134,818. ELECTRICAL HEATING UNIT AND RESISTANCE COIL; L. W. Campbell, South Yarra, Victoria, Australia. App. filed June 17, 1913. Washers of waste mica mounted on rod and compressed into solid mass.

1,134,840. TUNING TRANSFORMER FOR WIRELESS SYSTEMS; R. R. Goldthorp, Hartford, Conn. App. filed Dec. 15, 1913. Renders sharp tuning possible.

1,134,853. ELECTRO-PNEUMATIC BRAKE; C. N. Holcombe (deceased), New Rochelle, N. Y. App. filed Jan. 22, 1914. Motorman's valve.

1,134,886. ELECTRIC STOVE; W. F. Merrill, New York, N. Y. App. filed July 10, 1914. Has interchangeable insulating tablets with wire wound around.

1,134,909. WAY SIGNAL; J. M. Rosselot, Cincinnati, Ohio. App. filed Jan. 20, 1914. For signaling intended direction of automobiles.

1,134,933. TELEPHONE SWITCHING APPARATUS; B. D. Willis, Chicago, Ill. App. filed March 27, 1911. Semi-automatic system.

1,134,954. ELECTRIC FIXTURE; J. E. Keough, Boston, Mass. App. filed April 19, 1913. Strain-relief construction for lamp sockets.

1,134,959. LIGHT FOR WELLS OR CAISSONS; W. J. Newman, Chicago, Ill. App. filed Aug. 28, 1913. Battery lamps constructed for hanging in excavation.

1,134,977. POCKET FLASHLIGHT; H. H. and H. T. Hipwell, Pittsburgh, Pa. App. filed April 11, 1914. Construction for locking the switch.

1,134,978. SEMI-AUTOMATIC TELEPHONE-EXCHANGE TRUNKING SYSTEM; E. A. Mellinger, Chicago, Ill. App. filed Feb. 5, 1910. Supervisory arrangement.

1,134,982. ABSOLUTE PERMISSIVE BLOCK SIGNAL SYSTEM; S. N. Wight, Rochester, N. Y. App. filed July 8, 1911. Obviates need for certain electrical adjustments.

1,134,983. SYSTEM OF ELECTRICAL TRANSMISSION; R. A. Engler, Dubuque, Ia. App. filed July 13, 1914. Sound-producing electric lamp.